BRITISH COLUMBIA

COASTAL FISHERIES FORESTRY GUIDELINES

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B.C. Ministry of Forests
B.C. Ministry of Environment
Federal Department of Fisheries and Oceans
Council of Forest Industries

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Coastal Fisheries/Forestry
Guidelines

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PREFACE

The Coastal Fisheries/Forestry Guidelines were developed by industry and the agencies that jointly have direct control over integrated resource management in coastal watersheds. The purpose of the Guidelines is to provide a common basis for applying joint management principles to assist the agencies in achieving their respective objectives. Because these objectives are, to some degree, competitive and conflicting, their mutual full achievement will not always be possible within practical operating constraints.

The Guidelines consist of six documents. The first is a 'Statement of Principles' which outlines a number of operating principles with respect to management issues. Attached to this is a definition of the four classes of stream reach and associated fish habitat management objectives. The third document is a 'Field Guide' which summarizes the major guidelines for all aspects of forestry operations to protect fish habitats in accordance with stream reach class objectives. This guide will act as a ready reference in the field. Additional detail and examples are presented in the 'Reference Guide'. The balance of the documentation is a glossary of terms used in the Guidelines and a set of appendices that contain special technical information and approved regulatory procedures established by government agencies.

These guidelines are not intended to be complete or definitive. They have been developed by consensus based on past operating experience and the most current research information. After being used for a trial period of two years throughout coastal British Columbia, these guidelines will be evaluated, refined and adjusted as required.

Finally, it should be emphasized that these Guidelines do not override or nullify the legislative mandate of management agencies. They serve to guide established management processes, but clear violations of these mandates will continue to be dealt with through existing legal procedures. Hopefully, the presence of the Guidelines will reduce such occurrences to a minimum.

COASTAL FISHERIES/FORESTRY GUIDELINES

A STATEMENT OF PRINCIPLES

The concept of integrated resource management recognizes that both forestry and fisheries share a common watershed base, and that strategies which enable the sustained development of timber and fisheries resources through protecting their productive capabilities will generate a higher net benefit than single resource use. The objective of the Coastal Fisheries/Forestry Guidelines is, therefore, to maximize the net benefits of the combined fisheries and forestry resources, while minimizing time and cost.

The Coastal Fisheries/Forestry Guidelines have been developed to assist in integrating fisheries and forestry management in coastal British Columbia. They are intended to improve the performance and effectiveness of the consultative process required for fish habitat protection and concurrent forest harvesting management, but they are not intended to replace ongoing site inspections that are such an important aspect of integrated fisheries/forest management. Hence, these Guidelines strengthen the developing cooperation between resource management agencies and the forest industry.

Based on this statement of philosophy, the Coastal Fisheries/Forestry Guidelines warrant additional perspective and comment:

1. Forest management related to a range of fisheries value:

   The stream reach classification system identifies a range of fisheries habitat values and is used as the basis for determining related forest management practices in watersheds. The objective of these Guidelines, as stated above, can be achieved by integrating forest harvesting practices with fish habitat values.

   Highest value fisheries habitats (Class I) require the highest level of management effort, from both fisheries and forest managers, to maintain productive capabilities. Lowest value habitats (Class IV) require minimal protection, with fisheries protection measures limited to those required in consideration of downstream impacts on higher class reaches.

   Use of these guidelines requires that stream reaches be classified for each watershed. Existing fisheries information is sufficient to determine stream reach classes in many watersheds but in some watersheds additional inventory will be required. The required information will become available as the federal/provincial fish habitat inventory and information program is implemented. Occasional situations may arise where industry must change operational plans and move quickly into watersheds with no inventory adequate for stream classification; under such circumstances, industry and government would cooperate in obtaining the necessary inventory. Habitat management objectives are based on the stream reach class, and assist in determining appropriate forest management practices. Where information obtained during forest operation development will occasion reclassification to a higher order stream, adjustments to objectives may be necessary in consideration of the extent of the development that has already been committed.

The stream reach classification system and the associated guidelines are based on a synthesis of research information from the Pacific Northwest(Oregon to Alaska) combined with field experience derived from the fisheries and forestry agencies and the forest industry. They support the development of on-site management decisions, and indicate where management attention should be focused.

2. Basis for Stream Classification:

The value of stream habitats determines the stream reach class and includes consideration of fisheries management plans which have been approved at the Director level of Government for upgrading of specific reaches. Stream reaches programmed for enhancement will be assigned the appropropriate higher class. Stream reaches not in the current program for enhancement at the time of logging plan development will be managed consistent with their present classification.

3. Rate of Cut Consideration:

While these guidelines address immediate site specific practices, the time period over which forest development plans apply may be less than that required for some biological and physical processes to occur. Consideration may, therefore, be required of the total area of timber harvested in a watershed over a given period of time. This rate of cut issue is presently being addressed by a fisheries-forestry technical committee. When the report is released and accepted, any pertinent recommendations will be included in these guidelines.

4. Resolving Conflicts and Uncertainty:

Even the best integrated management process can suffer from inadequate information or differences of opinion. The application of these guidelines will therefore always be guided by professional judgement and by common sense leading to the development of site-specific solutions to problems. When uncertainty exists, degree of risk and magnitude of potential effect on habitat must be considered and appropriate decisions made to minimize impact.

In the case of disagreement which cannot be resolved at the operational level, guidance from successively higher levels of management will be sought in accordance with the Interagency Agreement on Resource Management Conflict Resolution between the Ministry of Forests the Ministry of Environment and the Department of Fisheries and Oceans (Appendix I).

5. Training and Information Requirements:

Understanding the stream classification system, taking management decisions in the field and making use of tools available to fisheries and forestry managers, require education and training. Training programs will be conducted for all involved staff to facilitate mutual understanding of these guidelines and their effective application in the field.

A Field Guide for field staff has been developed which, in combination with this Statement of Principles and the Reference Guide, will form the Coastal Fisheries/Forestry Guidelines. These guidelines will be reviewed and updated as required and the training programs will be repeated from time to time.

6. Monitoring and Evaluation:

The effectiveness of these guidelines in terms of achieving their objective for maximizing net benefits will be monitored. This monitoring program will include assessing costs to the forest resource to protect fisheries habitat values, the degree to which fish habitat objectives have been achieved, and the efficiency in reducing and resolving conflicts and making management decisions in the field.

STREAM REACH SPECIFICATIONS AND OBJECTIVES

Class I

Anadromous salmonids or moderate to high levels of resident sports fish are present, or the reach has been identified for upgrading in an approved fisheries management plan. Stream gradient is usually less than 8%. The objective is to maintain productive capacity of the fish habitats including water quality and stream channel characteristics. To provide flexibility, it may be necessary to design compensating or mitigating measures which offset the unavoidable effects which even careful forest harvesting may have on a stream system.

Class II

Low levels of resident sport fish are present. Stream gradient is usually 8%-12%. The objective is to minimize loss of productive capacity of the fish habitats and maintain sufficient stream channel integrity to protect Class I reaches from accelerated transport of sediment or debris.

Class III

Resident non-sport fish are present. Stream gradient is usually 8%-20%. The objective is to maintain the genetic stock of indigenous species and maintain sufficient stream channel integrity to protect Class I, and Class II reaches which may be impacted from accelerated transport of sediment or debris.

Class IV

No fish are present and stream gradient is usually greater than 20%. The objective is to maintain sufficient stream channel integrity to protect Class I, and Class II reaches which may be impacted from accelerated transport of sediment or debris.

COASTAL FISHERIES/FORESTRY GUIDELINES

FIELD GUIDE

The Field Guide has been developed for field use. The Reference Guide is available for expansion of the subject matter and provision of examples.

The following presents the planning and operational guidelines applicable to the four Stream Reach Classes for each forest harvesting and silvicultural phase. As early as possible, industry should identify proposed areas for logging which require additional information for stream classification in order to identify important stream values when information is not available. All phases of harvesting should be planned with due consideration to the distribution of stream reach classes and the potential for downstream impacts in the watershed. Sufficient data should be acquired which are pertinent to all phases of forest management activities, such as maps of bedrock geology, surficial geology, soil types and stability hazards. These maps should be used to identify potentially unstable slopes for which more detailed studies may be required.

The stream reach classes to which guidelines are applicable are indicated by]]] . An • indicates that the guidelines apply only when class I or II reaches downstream may be impacted.

	STREAM REACH CLASS I	II	III	IV
A. PLANNING AND CONSTRUCTION FOR ROADS AND LANDINGS:				
Consider the logging system, logging pattern and special road building techniques to permit efficient forest development and harvesting while optimizing environmental protection.				
Considerations required to achieve this are:				
• constructing roads reasonable distances from Fisheries Sensitive Zones.	]]]]]]]]	•	•	
• avoiding construction in highly sensitive areas of slope instability unless Agency approval obtained.	]]]]]]]]]]]]]]]]]]			
• stopping construction during extremely unfavorable soil moisture conditions and making necessary modifications to minimize erosion.	]]]]]]]]	•	•	
• avoiding deposit of construction debris or sidecast material into waterbodies or where it may enter a waterbody.	]]]]]]]]	•	•	
• scheduling construction to take into account fish life cycles and water flows.	]]]]]]]]	•	•	
B. RIGHT-OF-WAY FELLING, CLEARING AND SUBGRADE CONSTRUCTION:				
Emphasis to be placed on the falling patterns and construction techniques to minimize sedimentation, rock, and organic debris impacts on streams.				
Considerations required to achieve this are:				
• falling right-of-way trees away from stream reaches.	]]]]]]]]	•	•	

STREAM REACH CLASS
I II III IV

- selecting suitable material, equipment, and techniques.]]]]]]]] • •
- providing adequate subgrade drainage.]]]]]]]] • •
- maintaining slope stability during subgrade construction.]]]]]]]] • •
- preventing, where practical, blasted rock from entering waterbodies.]]]]]]]]
- stopping operations if a slide occurs which enters or may enter a waterbody, and notifying the Forest Officer immediately.]]]]]]]] • •

C. BALLASTING AND SURFACING:

Emphasis to be placed on minimizing road surface erosion.

Considerations required to achieve this are:

- using suitable surface materials.]]]]]]]]]]]]]]]]]]
- the road surface must be above water table during the operating period.]]]]]]]] • •

D. PITS AND QUARRIES:

In developing road surface materials, considerations required are:

- controlling drainage of water or other deleterious products from pits and quarries.]]]]]]]] • •
- obtaining approval of a Fisheries Officer for gravel removal from the stream channel.]]]]]]]] • •

E. FUEL STORAGE:

Avoid fuel spillage or the potential for spillage during fuel storage and fueling operations.]]]]]]]]]]]]]]]]]]]]

F. CUTS AND FILLS:

Emphasis to be placed on avoiding sediment additions which have the potential to directly affect stream channels.

Considerations required to achieve this are:

- stable angle of repose.]]]]]]] • •
- road and sidecast stability.]]]]]]] • •
- initiating stabilization efforts immediately on steep slopes.]]]]]]] • •

G. DRAINAGE, INCLUDING BRIDGES AND CULVERTS:

Emphasis to be placed on drainage design and construction to minimize stream sedimentation and maintain channel integrity.

Considerations required to achieve this are:

- identifying continuous and intermittent streams during time of road survey.]]]]]]]]]]]]]]]]]]

	STREAM REACH CLASS I	II	III	IV
• ensuring that the drainage design is adequate to handle interrupted surface and sub-surface flows.	]]]]]]]]]]]]]]]]]]]]			
• installing sufficient culverts to prevent ditch erosion, and in a manner to prevent outflow erosion.	]]]]]]]]]]]]]]]]]]]]			
• providing adequate drainage for water courses concurrently with subgrade construction and installing all drainage structures by the time ballasting is completed.	]]]]]]]]]]]]]]]]]]]]			
• designing culvert and bridge capacity to avoid channel scouring and road washouts.	]]]]]]]]]]]]]]]]]]]]			
• maintaining width and gradient of active stream channels with preference for the use of wooden culverts or pipe arches for fish passage.	]]]]]]]]			
• maintaining bridge abutments above the high water mark of the stream channel.	]]]]]]]]	•	•	
• satisfying fish life cycle timing and activity constraints for bridge construction.	]]]]]]]]	•	•	
• satisfying instream equipment operation constraints for bridge construction.	]]]]]]]]	•	•	
• clearing culverts and bridges of debris.	]]]]]]]]]]]]]]]]]]]]			

H. MAINTENANCE OF LOGGING ROADS:

Emphasis to be placed on retention of the road surface and drainage structure integrity.

Considerations required to achieve this are:

• conducting intensive maintenance as per MOFL minimum road specifications prior to long shutdowns and peak stream flow periods.	]]]]]]]]]]]]]]]]]]]]			
• leaving roads, drainage structures, and water courses in a condition suitable to minimize erosion following harvesting.	]]]]]]]]]]]]]]]]]]]]			

I. PLANNING AND OPERATIONS FOR FALLING AND YARDING:

Emphasis to be placed on minimizing stream sedimentation and maintaining streambank and channel integrity.

Considerations required to achieve this are:

• providing available physical and environmental information or interpretative data for each opening during the preparation of a Five-Year Development Plan submission.	]]]]]]]]]]]]]]]]]]]]			
• evaluating landslide and erosion hazards and utilizing special measures where required.	]]]]]]]]]]]]]]]]]]]]			
• choosing appropriate yarding systems for the site, yarding uphill where practical.	]]]]]]]]]]]]]]]]]]]]			

	STREAM REACH CLASS I	II	III	IV

J. GROUND-SKIDDING SYSTEMS:

Emphasis is to be placed on minimizing stream sedimentation and maintaining streambank and channel integrity.

Considerations required to achieve this are:

- thoroughly assessing whether to utilize this system on slopes greater than 30%.]]]]]]]]]]]]]]]]]]
- locating of major skid roads to avoid continual and random stream crossings, erodible soils and continuous steep grades.]]]]]]]] • •
- suspending operations where required during high soil moisture conditions.]]]]]]]] • •
- avoiding Fisheries Sensitive Zones with skid roads.]]]]]]]]
- avoiding active or ephemeral streams and zones of seepage with landing locations.]]]]]]]] • •

K. STREAMSIDE AREAS:

Emphasis will be placed on maintaining streambank and habitat integrity.

Considerations required to achieve this are:

- protecting Fisheries Sensitive Zones.]]]]]]]]
- evaulating potential window hazard and impacts.]]]]]]]] • •
- undertaking instream activities in recognition of timing windows relative to fish life cycles and water flows. (See Reference Guide 2.5.4)]]]]]]]] • •
- needing to delineate and protect a streamside management zone or leave strip.]]]]]]]]
- retaining mature trees to maintain stability of the channel and L.O.D. sources and to prevent forest site loss on major class III and IV streams.]]]]]]]]
- employing agency approved directional falling and yarding techniques.]]]]]]]] • •
- for cross-stream yarding consider:

  i) stream bank stability
  ii) instream L.O.D.
  iii) stream capability to transport debris

  If banks are unstable, the area has gullied terrain with deep soils, or L.O.D. is stabilizing the channel and logging may disturb or destabilize these conditions, then fall and yard away.]]]]]]]] • •

  If banks are stable and the channel is not stabilized by L.O.D., then consider the potential for falling across and yarding over the channel subject to debris transport capability evaluation and possible debris removal requirements. • •
- preventing the introduction of debris (fall away, yard away).]]]]
- using streams as lateral boundaries for yarding roads.]]]]]]]]

	STREAM REACH CLASS I	II	III	IV
• carefully supervising recommended stream cleanup.	]]]]]]]]	•		•
• evaluating impacts of harvesting operations on downstream values.			]]]]]]]]	
• taking streambank or slope stabilization measures following logging in the event of instability or accelerated erosion.	]]]]]]]]]]]]]]]]]]			

L. PLANNING AND OPERATIONS FOR SILVICULTURE:

Emphasis will be placed on permitting efficient reforestation while optimizing environmental protection.

Considerations required to achieve this are:

• Identifying silvicultural requirements for problem sites at the time of preharvest assessment.	]]]]]]]]	•		•
• selecting strategies and equipment to minimize ground disturbance where brush competition and erosion are problems.	]]]]]]]]	•		•
• protecting established streamside management zones, Fisheries Sensitive Zones, or leave strips during post-harvesting treatment.	]]]]]]]]]]]]]]]]]]			
• controlling chemical applications in accordance with the Pesticide Control Regulations.	]]]]]]]]]]]]]]]]]]			
• avoiding brush control on unstable sites where live root systems are required for stability.	]]]]]]]]]]]]]]]]]]			

M. BRUSH AND STREAMSIDE DECIDUOUS TREE CONTROL:

Emphasis will be placed on protection of Fisheries Sensitive Zones during pesticide applications and retention of streamside vegetation for erosion control, cover and streambank stability.

Considerations required to achieve this are:

• determining the need for alder seed tree control during preharvest assessment.	]]]]]]]]			
• implementing brush control programs.	]]]]]]]]	•		•
• assessing the contribution of streamside vegetation to stream productivity and streambank and channel stability prior to a decision to remove. (Consult with Agencies' staff before proceeding.)	]]]]]]]]	•		•
• considering timing sequence in extensive uniform stands of deciduous trees.	]]]]]]]]	•		•
• promoting coppicing	]]]]]]]]	•		•
• conforming with Pesticide Use Permit and obtaining Fisheries Agencies approval for herbicide applications within 10 meters of the stream.	]]]]]]]]]]]]]]]]]]			
• protecting pesticide free zones as required by the Pesticide Use Permit.	]]]]]]]]	•		•
• using ground-based treatments rather than aerial treatments where practical	]]]]]]]]	•		•
• take all precautions to minimizing drift into pesticide free zones during aerial pesticide applications.	]]]]]]]]	•		•

STREAM REACH CLASS
I II III IV

N. SCARIFICATION AND BURNING:

Emphasis will be placed on protection of streamside management zones and Fisheries Sensitive Zones.

Considerations required to achieve this are:

- keeping these activities away from protected zones, leave strips, and sites susceptible to erosion or debris transport from flooding.]]]]]]]] • •
- avoiding disturbance to stream channel integrity in the use of equipment.]]]]]]]]]]]]]]]]]

O. FERTILIZATION:

Emphasis will be placed on fertilizer applications to avoid detrimental effects on fisheries habitats.

This applies on a watershed basis for pelletized urea only

Considerations required to achieve this are:

- applying in fall or early winter preferred.
- determining the nutrient sensitivity and acceptable nitrogen loading of the watershed.
- avoiding during all phases of fertilizer handling, deposits into ditches and drainage channels, and fertilizer free zones.
- see 3.5.4 to 3.5.6 re fertilizer free zones.

COASTAL FISHERIES/FORESTRY GUIDELINES

REFERENCE GUIDE

The following presents the planning and operational guidelines applicable to the four Stream Reach Classes for each forest harvesting and silvicultural phase. As early as possible, industry should identify proposed areas for logging which require additional information for stream classification in order to identify important stream values when information is not available. All phases of harvesting should be planned with due consideration to the distribution of stream reach classes and the potential for downstream impacts in the watershed. Sufficient data should be acquired which are pertinent to all phases of forest management activities, such as maps of bedrock geology, surficial geology, soil types and stability hazards. These maps should be used to identify potentially unstable slopes for which more detailed studies may be required.

The stream reach classes to which guidelines are applicable are indicated by]]] . An • indicates that the guidelines apply only when class I or II reaches downstream may be impacted.

	STREAM REACH CLASS			
	I	II	III	IV
1.0 PLANNING AND CONSTRUCTION FOR ROADS AND LANDINGS:				
1.1 General				
1.1.1. Consider the logging system, logging pattern and special road building techniques, such as endhauling, to minimize soil disturbance. Plan road layout to permit efficient forest access development and harvesting, and environmental protection. Timing of construction or special measures should be related to the value of reach classes.	]	]	]	]
1.1.2. Take advantage of stable benches, ridge tops and gentle slopes. Avoid midslope roads wherever possible, particularly if a problem is identified.	]	]	]	]
1.1.3. Plan and construct roads a reasonable distance from Fisheries Sensitive Zones (see Glossary), to maintain vegetation and prevent instream damage and downstream sedimentation.	]	]	•	•
1.1.4. Construct roads to avoid areas with evidence of slope instability, unless the alignment is the best alternative and special design features which will prevent damage are incorporated into the plan. Where it is agreed by Agency staff that short sections of road must be constructed through highly-sensitive areas, there must be a critical evaluation with special construction restraints applied.	]	]	]	]
1.1.5. Stop construction during extremely unfavourable soil moisture conditions where siltation or debris will threaten fisheries values. Resume operations when conditions permit. It may be necessary to temporarily modify the site to ensure that erosion during the shutdown is minimized.	]	]	•	•
1.1.6. Avoid depositing construction debris or sidecast into any waterbody or at a location where it may subsequently enter a waterbody.	]	]	•	•

	STREAM REACH CLASS I	II	III	IV
1.2 Right of Way Felling, Clearing and Subgrade Construction:				
1.2.1. Give preference to the use of backhoes to minimize sidecasting and erosion in areas with steep slopes, unstable terrain, soils with low bearing strength, or high seepage. Crawler tractors should not be used in these areas.	]]]]]]]]]	•	•	
1.2.2. Where possible, fall right-of-way trees away from stream reaches.	]]]]]]]]]	•	•	
1.2.3. Stumps or organic material should not be incorporated into the subgrade where there is potential for failure into a watercourse.	]]]]]]]]]	•	•	
1.2.4. Ensure that subgrade is adequately ditched and drained during construction. (See Sec 1.7)	]]]]]]]]]	•	•	
1.2.5. Maintain slope stability during subgrade construction. If slides do occur during road construction, stop the operation and notify the Forest Officer immediately.	]]]]]]]]]	•	•	
1.2.6. Where possible, rock from blasting operations should not enter stream reaches.	]]]]]]]]]			
1.3 Ballasting and Surfacing:				
1.3.1. Minimize road surface erosion by the use of suitable surface materials for the anticipated speed and traffic frequency.	]]]]]]]]]]]]]]]]]]]			
1.3.2. The ballast should be of sufficient depth to elevate the road surface above the water table during the operating period.	]]]]]]]]]	•	•	
1.4 Pits and Quarries:				
1.4.1. Control water drainage from pits and quarries to prevent eroded material or other deleterious products from entering streams.	]]]]]]]]]	•	•	
1.4.2. Gravel removal from the stream channel requires approval of a Fisheries Officer.	]]]]]]]]]	•	•	
1.5 Fuel Storage:				
1.5.1. Avoid fuel spillage or the potential for spillage when storing fuel and during fuelling operations.	]]]]]]]]]]]]]]]]]]]			
1.5.2. Construct impermeable berms around storage areas to comply with existing government regulation (Appendix X.)	]]]]]]]]]]]]]]]]]]]			
1.6 Cuts and Fills:				
1.6.1. Avoid cuts and fills which have the potential to directly affect stream channels; however, if considered absolutely necessary, ensure that: a) Cut and fill slopes are designed and constructed at a stable angle of repose or less. (See Minimum road specs, Appendix V.) b) Full bench construction is recommended on steep slopes and sensitive sites. c) Sidecasting is not carried out on or above areas with potentially unstable accumulations of organic debris. d) On steep cut and fill slopes in sensitive areas, stabilization efforts are to be initiated immediately (e.g. terracing, revegation, cribwork, slope rounding).	]]]]]]]]]	•	•	

	STREAM REACH CLASS I	II	III	IV
1.7 Drainage, Including Bridges and Culverts: (See Appendix V, Min. Road Specs.)				
1.7.1. Identify continuous and intermittent streams for drainage planning purposes at the time of road survey and determination of location.	]]]]]]]]]]]]]]]]]]]]			
1.7.2. Ensure that the road drainage design is adequate for the handling of interrupted surface and sub-surface water flows. Install sufficient culverts to reduce the volume of ditch water and prevent ditch erosion, especially where significant groundwater is intercepted on steep slopes.	]]]]]]]]]]]]]]]]]]]]			
1.7.3. Provide adequate drainage for watercourses concurrently with subgrade construction and install all drainage structures (see Glossary) by the time ballasting is completed.	]]]]]]]]]]]]]]]]]]]]			
1.7.4. Provide adequate drainage at all road junctions.	]]]]]]]]]]]]]]]]]]]]			
1.7.5. The use of wooden culverts or pipe arches is preferred to provide for fish passage. Other provisions include: a) The design of drainage structures to maintain the width of the active stream channel. b) The maintenance of the natural stream gradient under the crossing structure (metal pipes should be partially buried in the streambed).	]]]]]]]]]			
1.7.6. When erosion is expected, direct culvert outflow to natural channels, non-erodible surfaces or suitable energy dissipating devices.	]]]]]]]]]	•	o	
1.7.7. Construct catch basins at culvert intakes of sufficient size to collect transported sediment and debris.	]]]]]]]]]]]]]]]]]]]]			
1.7.8. Clear debris from catch basins and channels, preferrably during low flow conditions, to prevent blockage of culverts.	]]]]]]]]]]]]]]]]]]]]			
1.7.9. Design culvert and bridge capacity of adequate size to avoid channel scouring and road washouts.	]]]]]]]]]]]]]]]]]]]]			
1.7.10. Satisfy recommended timing constraints for construction. (See Appendix II and guideline 2.5.4.)	]]]]]]]]]	•	•	
1.7.11. Bridge abutments should not encroach within the high watermark of the stream channel.	]]]]]]]]]	•	•	
1.7.12. Bridge construction should avoid scour, siltation, erosion and stream habitat damage.	]]]]]]]]]	•	•	
1.7.13. Minimize the use of machines in streams. Stream fording with equipment should be at one location only. Obtain approval for the instream operation of equipment from the Fisheries Agencies.	]]]]]]]]]			
1.7.14. Obtain approval for instream operation of equipment from Fisheries Agencies for bridge construction in areas of sensitive soils.			•	•
1.8 Maintenance of Active Use Logging Roads: (See Glossary)				
1.8.1. Retain the integrity of the road surface, drainage structures and water quality throughout the maintenance program.	]]]]]]]]]]]]]]]]]]]]			
1.8.2. Conduct intensive maintenance as per MOFL minimum road specifications prior to long shutdowns and peak stream flow periods, e.g. culvert and ditch cleanout, cross ditching, etc.	]]]]]]]]]]]]]]]]]]]]			

STREAM REACH CLASS
I II III IV

1.9 Maintenance of Inactive Logging Roads: (See Glossary)

Identify roads after harvesting as either "limited access" or "abandoned".

1.9.1. Limited Access Roads (See Glossary)

Take the following steps for long term road stabilization:]]]]]]]]]]]]]]]]]]]]

a) Remove culverts that demonstrate a serious maintenance problem.
b) Cut cross ditches to further reduce the volume of ditch water and to re-establish natural flow patterns.
c) Where openfaced culverts or cross drains are used on inactive roads (for waterflow across the road), provide for a non-erodible armouring surface.

1.9.2. Abandoned Roads (See Glossary)

Take the following steps for permanent road stabilization:]]]]]]]]]]]]]]]]]]]]

a) Leave roads in a condition suitable to minimize erosion, e.g. remove culverts and road fill material from gullies and stream channels to permit open flow and stable channel conditions. Revegetation may be required.
b) Stabilize existing surface drainage patterns and deposit excavated material in a stable location.
c) Frequent cross ditches may be required on steep grades.

STREAM REACH CLASS
I II III IV

2.0 PLANNING AND OPERATIONS FOR FALLING AND YARDING:

2.1 General:

2.1.1. Include the following information and/or interpretations, when available, during the preparation of a Five Year Development Plan: location, extent and configuration of blocks; topographic details; windthrow potential; landing locations; season of extraction; terrain stability maps or data; E.S.A. information; and any other relevant data to identify high risk areas.]]]]]]]]]]]]]]]]]]]]

2.1.2. Evaluate landslide and erosion hazards in steep or otherwise unstable areas where a relatively small disturbance may lead to a debris torrent, mass wasting or erosion problem (slumps, landslides, rilling, etc.). Where these hazards exist, harvesting will require special measures.]]]]]]]]]]]]]]]]]]]]

2.1.3. Cable yarding or aerial (helicopter and balloon) systems are preferred as they create less ground disturbance.]]]]]]]]]]]]]]]]]]]]

2.1.4. Yard uphill wherever possible to minimize the risk of yarding across or adjacent to streams and to minimize the valley bottom concentration or convergence of erosion channels that may be caused by downhill yarding.]]]]]]]]]]]]]]]]]]]]

2.2 Ground Skidding Systems:

2.2.1. Generally, these systems should not be employed on slopes greater than 30%.]]]]]]]]]]]]]]]]]]]]

2.2.2. Prevent soil erosion and resulting stream sedimentation and preserve the natural streambank integrity, water flow and water quality by:]]]]]]]]] • •
a) Locating major skid roads prior to the commencement of skidding, especially for winter skidding operations, to avoid continual and random stream crossing. Choose locations that avoid erodible soils.
b) Minimizing the length of skid roads to reduce erosion potential.
c) In areas which have erosion problems during high soil moisture conditions, suspending skidding operations.

2.2.3. Locate landings away from active or ephemeral streams or zones of soil seepage.]]]]]]]]] • •

2.2.4. Design skid roads to avoid Fisheries Sensitive Zones, e.g. active flood plains, stream bottoms, etc. (See Glossary.)]]]]]]]]]

2.2.5. Avoid skid roads with continuous steep grades. Where steep grades are necessary, construct water bars to divert runoff to undisturbed areas.]]]]]]]]] • •

2.3 Helicopter or Balloon Systems:

2.3.1. Plan helicopter or balloon yarding systems considering the effects of flight paths, block configuration and staging areas on potential slash accumulation and debris fallout problems, to ensure water systems are not polluted or obstructed.]]]]]]]]] • •

2.3.2. Apply debris management guidelines when flight lines are over open water, including stream channels.]]]]]]]]] • •

	STREAM REACH CLASS I	II	III	IV
2.3.3. Limb at the setting.	]]]]]]]]]]]]]]]]]]]			
2.3.4. Locate drop sites away from Fisheries Sensitive Zones such as estuaries and shellfish beds, or productive lake littoral zones.	]]]]]]]]]			
2.3.5. Locate drop sites and log handling areas beyond the littoral zone in both marine and freshwater systems (or beyond 10 m depth).	]]]]]]]]]			
2.3.6. Recover floating and sinking debris in Fisheries Sensitive Zones to reduce the physical impact and chemical contamination of the water. This could involve: a) Perimeter containment booms. b) Periodic surface sweeping of the drop area. c) Dredging of the bottom debris. d) Disposal of debris by burning or transport to an acceptable location.	]]]]]]]]]			

2.4 "A" Frame and Handlogging Systems:

2.4.1. "A" frame and handlogging operations have the potential to physically damage the site or deposit large quantities of debris in water. Therefore, only consider them in deeper water locations (beyond the 10 meter depth) well away from Fisheries Sensitive Zones.

2.4.2. Take the following measures to reduce any potential slash and debris problems:
a) Employ perimeter containment booms.
b) Minimize falling into the water.
c) Buck and limb on land.
d) Remove contained debris and either place it back on shore in a stable location or dispose of it at an acceptable location.

2.5 Streamside Areas

	STREAM REACH CLASS I	II	III	IV
2.5.1. Protect Fisheries Sensitive Zones. (See Glossary.)	]]]]]]]]]			
2.5.2. Consider the impacts of harvesting operations on downstream values, e.g. Fisheries Sensitive Zones, community water supply, etc.			]]]]]]]]]	
2.5.3. Consider the potential for windthrow and the consequences if it should occur, e.g. special circumstances such as high windthrow risk will require consideration that only one side of a valley be developed at one time and development of the remaining side be delayed until the logged areas have stabilized.	]]]]]]]]]	•	•	
2.5.4. Take timing constraints into consideration relative to fish life history phases, expected stream flows, debris management, operations on floodplains or extremely wet soil moisture conditions. Preference is given to periods of summer low flow for instream activities. Consultation with the local DFO and MOE&P staff may afford site specific variation, e.g. "Operating Window" usually relates to June 1 - September 15; Queen Charlotte Islands: June 1 - August 15. (See Appendix II.)	]]]]]]]]]	•	•	
2.5.5. Delineate and protect a streamside management zone (see Glossary) or leave strip which will provide: streambank and riparian vegetation stability; future source of large organic debris (L.O.D. See Glossary).	]]]]]]]]]			

	STREAM REACH CLASS I	II	III	IV
2.5.6. To prevent forest site loss on major Class III and IV streams where bank stability or large organic debris is playing a significant role in stabilizing the channel, mature streamside trees may be required as a future source of L.O.D. Heavy leaners, snags and danger trees will often serve this purpose.			]]]]]]]]]	
2.5.7. In streamside areas prone to blowdown, employ directional falling to remove merchantable trees. Heavy leaners and danger trees may be either left standing or fallen directly across the stream based on an on-site inspection with Fisheries Agencies. Where yarding of these trees will create streambank or in-stream damage, leave a portion of the stem (a "bridge") spanning the creek in a stable position. This may apply to major streams of Class III and IV.	]]]]]]]]]	•	•	
2.5.8. The streamside management zone may include protection of snags, where compatible with Workers' Compensation guidelines, or leaving of non-merchantable trees as a future supply of snags or L.O.D. In addition, non-merchantable conifers or alder may have to be retained in the streamside zone to provide nest sites for cavity nesting birds and perching, or nest sites for raptors (see Glossary).	]]]]]]]]]			
2.5.9. Consider ways to prevent the introduction of debris such as: fall away, yard away.	]]]]			
2.5.10. Use streams as lateral boundaries for yarding roads, unless topographic and/or deflection conditions will ensure no disturbance of streamside vegetation and/or damage of instream habitat.	]]]]]]]]]			
2.5.11. The potential for cross-stream yarding is influenced by: i) stream bank stability: ii) instream L.O.D.: iii) stream capability to transport debris.				
a) If banks are unstable, the area has gullied terrain with deep soils, or L.O.D. is stabilizing the channel and logging may disturb or destabilize these conditions, then fall and yard away.	]]]]]]]]]	•	•	
b) If banks are stable and the channel is not dependent on L.O.D. for stability, then consider the potential for falling across and yarding over the channel subject to debris transport capability evaluation:		•	•	
i) if the channel does not have the capability to transport debris, then cross stream falling and yarding may be undertaken without debris clean out.				
ii) if the channel has the capability to transport debris, then minimize debris entering the channel as debris clean-up will be required:				
- Debris entry into watercourses can be minimized by such methods as directional falling or appropriate yarding systems.				
- As an alternative to onsite debris cleanup, consider the use of a debris trap or grizzley. Debris traps may only be used where the channel is stabilized by bedrock or boulders and an accessible, stable site exists for trap installation and debris removal.				
- The operation should be carried out with consideration to seasonal timing (see Appendix II).				
2.5.12. Where stream clean-up of moving debris (see glossary) is recommended it must be carefully supervised. It is possible to destroy useful habitat through over-zealous clearance programs. Clean-up may have to be conducted in two phases: a) Immediately following or concurrently with logging. b) Following the first freshet or series of freshets after logging.	]]]]]]]]]	•	•	

STREAM REACH CLASS
I II III IV

2.6 Post-Operational:

2.6.1. In the event of slope instability or accelerated erosion in a cutblock after logging operations, stabilization measures should be taken to maintain forest site productivity and to minimize stream impacts. (See Appendix VII)]]]]]]]]]]]]]]]]]]]]

2.6.2. If streambank erosion is occurring or has potential to occur, consider planting grasses, brush or tree species, or placing organic or inorganic armouring material to prevent streambank erosion or sedimentation.]]]]]]]]] • •

3.0 PLANNING AND OPERATIONS FOR SILVICULTURE:

3.1 Silvicultural Considerations in Harvesting Layout and Method:

3.1.1. Identify potential silviculture problem sites at the time of preharvest assessment and develop the most feasible plan to minimize problems with available engineering advice. (See Appendix IX)]]]]]]]]] • •

3.1.2. Choose strategies and equipment to minimize ground disturbance where brush competition and erosion are problems. Excessive soil disturbance not only leads to erosion which may cause siltation in streams, it also promotes brush encroachment. Avoid exposure of mineral soils (e.g. by scarification).]]]]]]]]] • •

3.1.3. Where it has been determined that slashburning will be part of the post-harvest treatment, layout harvest boundaries to facilitate the protection of established streamside management zones.]]]]]]]]]]]]]]]]]]]

3.1.4. Design block layout to facilitate possible use of aerial methods if fertilizer or herbicide application is expected (see Section 3.2).]]]]]]]]] • •

3.2 Brush and Streamside Deciduous Tree Control

(No part in 3.2 supercedes conditions of a Pesticide Use Permit.)

3.2.1. Assess the need for alder seed tree control during the pre-harvest planning stage. Treat streamside alder throughout all phases of logging and silviculture accordingly. This should be reviewed whenever possible during the Five Year Development Plan meeting.]]]]]]]]]

3.2.2. Where necessary, design a roadside brush control program to minimize the spread of brush into plantations.]]]]]]]]] • •

3.2.3. Avoid brush control on streamside and upland sites that are dependent on live root systems for stability.]]]]]]]]]]]]]]]]]]]

3.2.4. Protect a streamside management zone or leave strip established during the harvesting phase when using either mechanical or herbicide brush control methods.]]]]]]]]]]]]]]]]]]]

3.2.5. Maintain deciduous tree and brush species, in particular alder, where they are considered to be important for erosion control, stabilization of the streambank, cover or water temperature control. Consult with Fisheries Agencies and MOFL prior to the removal of streamside vegetation.]]]]]]]]] • •

3.2.6.A. Retain streamside alder seed trees unless sufficient streamside vegetation is present to adequately provide for stream productivity and the alder to be treated are not contributing to streambank and channel stability.]]]]]]]]]

B. Alder present on high-site flood plains adjacent to small, low energy tributaries and swamps may be removed, provided other deciduous vegetation or juvenile alder, less than 7 m, are present to provide streambank stability, adequate cover and biomass inputs.

	STREAM REACH CLASS I	II	III	IV
3.2.7. Where streamside alder removal has been approved by Fisheries Agencies and MOFL, consider mechanical removal, possibly during the harvesting phase. Cutting so as to leave high stumps and felling away from the stream are preferred to either girdling or herbicide applications because the former promotes coppicing and maintenance of the living roots. Consider other methods to promote coppicing.	]]]]]]]]]	•	•	
3.2.8. Where approved to mechanically treat stands of mature or juvenile streamside deciduous trees in areas where they occur in uniform, extensive stands, carry out the treatment over a time phase sequence (See Glossary). Clean the stream channel of any debris resulting from deciduous tree control activities.	]]]]]]]]]	•	•	
3.2.9. Herbicide use, including individual tree treatment, is generally not acceptable within 10 m of watercourses. For any herbicide applications considered within 10 m of watercourses, obtain approval from Fisheries Agencies or Pesticide Control Branch on a site specific basis. Ensure that the intended treatment is stipulated in the Pesticide Use Permit.	]]]]]]]]]]]]]]]]]]			
3.2.10. Identify and take measures as necessary to protect pesticide free zones as required by the Pesticide Use Permit. Ensure that small sidechannels and other waterbodies connected by streams, which are often obscured by brush cover, are located and protected.	]]]]]]]]]	•	•	
3.2.11. Where practical, use ground based treatments rather than aerial treatments. The buffer zone for ground based applications will be much smaller than for aerial applications.	]]]]]]]]]	•	•	
3.2.12. Conduct aerial applications with staff experienced in that method of application. Leave appropriate buffer zones and use ground application methods to ensure that the pesticide free zone is maintained along waterbodies. Take all precautions to minimize drift (See Pesticide Control Branch Aerial Spray Guidelines in Appendix VI.)	]]]]]]]]]	•	•	
3.3. Site Preparation by Scarification:				
3.3.1. Scarify only those areas not included in the streamside management zones, fisheries sensitive zones, or leave strips established during the falling and yarding phase.	]]]]]]]]]]]]]]]]]]]]			
3.3.2. Scarify only those sites which are not susceptible to erosion or debris transport from flooding.	]]]]]]]]]	•	•	
3.3.3. Avoid moving large organic debris which is associated with the stream channel and extends outside the streamside management zone or leave strip.	]]]]]]]]]]]]]]]]]]]]			
3.4. Site Preparation by Prescribed Fire:				
3.4.1. Burn only those areas not included in streamside management zones or leave strips established during the falling and yarding phase. Special measures may be required to protect no-treatment zones, e.g. sprinklers.	]]]]]]]]]]]]]]]]]]]]			
3.4.2. Avoid use of equipment to create fireguards adjacent to Class I waters where connecting sidechannels may be disturbed.	]]]]			

STREAM REACH CLASS
I II III IV

3.5. Fertilizer Application:

These guidelines apply to the application of pelletized urea only. Special measures may be required for the use of other fertilizers.

The guidelines are applied on a watershed basis rather than on a stream reach basis.

3.5.1. Plan for fall/early winter as primary application times.

3.5.2. In nutrient sensitive watersheds, the area approved for fertilization will be determined by the acceptable level of nitrogen loading to the stream.

3.5.3. Heliports should be located in dry areas, well removed from ditches or natural water bodies. Any drainage through heliports must be directed away from ditches or natural water bodies prior to use.

3.5.4. For those water bodies requiring a fertilizer free zone (FFZ), provide a 30 m FFZ in nutrient sensitive watersheds (see Glossary and Appendix IX) and a 10 m FFZ in non-sensitive watersheds.

3.5.5. Treatment boundaries are to be laid out so as to avoid inclusion of water bodies requiring a FFZ within the block. If this can not be accommodated, then lines should be flown parallel to the creek or water body to provide a buffer before applying fertilizer to the remainder of the block (see Appendix VIII.)

3.5.6. Flight lines should be laid out so as to avoid deposition of fertilizer within defined fertilizer free zones. Flagging of the zone may be required on a channel which has open water but may not be observed as such at the time of application.

APPENDIX I: Interagency Agreement on Resource Management Conflict Resolution between Ministry of Forests, Ministry of Environment and Department of Fisheries and Oceans.

Interagency Agreement on Resource Management Conflict Resolutions

(1) It is agreed by the parties involved that the first level of interagency conflict resolution shall be at the Region or Area level.

(2) Problems which cannot be resolved at the Region or Area level shall specifically be referred by the senior region or area officers to their Headquarters' supervisor.

(3) The Headquarters' officers responsible for field operations of the 3 agencies shall jointly attempt resolution of the problem.

(4) If an issue cannot be resolved in Step 3 above, it shall be referred to the three signatories of this agreement.

(5) Prior to an attempt at resolution by the signatories, no independent, external action (including press releases) will be taken by one agency without advance notification to the other signatories.

Signed: Dated:

H. D. Johnston, A.D.M., Pacific & Freshwater Fisheries — Jan 15/82

T. M. Apsey, Deputy Minister, Ministry of Forests — Oct 19/81

B. E. Marr, Deputy Minister, Ministry of Environment — Sept 21/81

MOFL/MOEP/DFO PROTOCOL AGREEMENT: RESPECTIVE ACCOUNTABILITY LEVELS OF DECISION MAKING AUTHORITY

	MOFL	MOEP	DFO
1.	Minister	Minister	Minister
2)	Deputy Minister	Deputy Minister	Assistant Deputy Minister
3)	Assistant Deputy Minister	Assistant Deputy Minister	Director General
4)	Regional Manager	Regional Director	Area Manager *(Director Field Services)
5)	District Manager	Regional Manager	District Supervisor
6)	Operation Superintendant	Regional Habitat Protection Section Head	Assistant District Supervisor
7)	Resource Officer	Habitat Technician	Fishery Officer

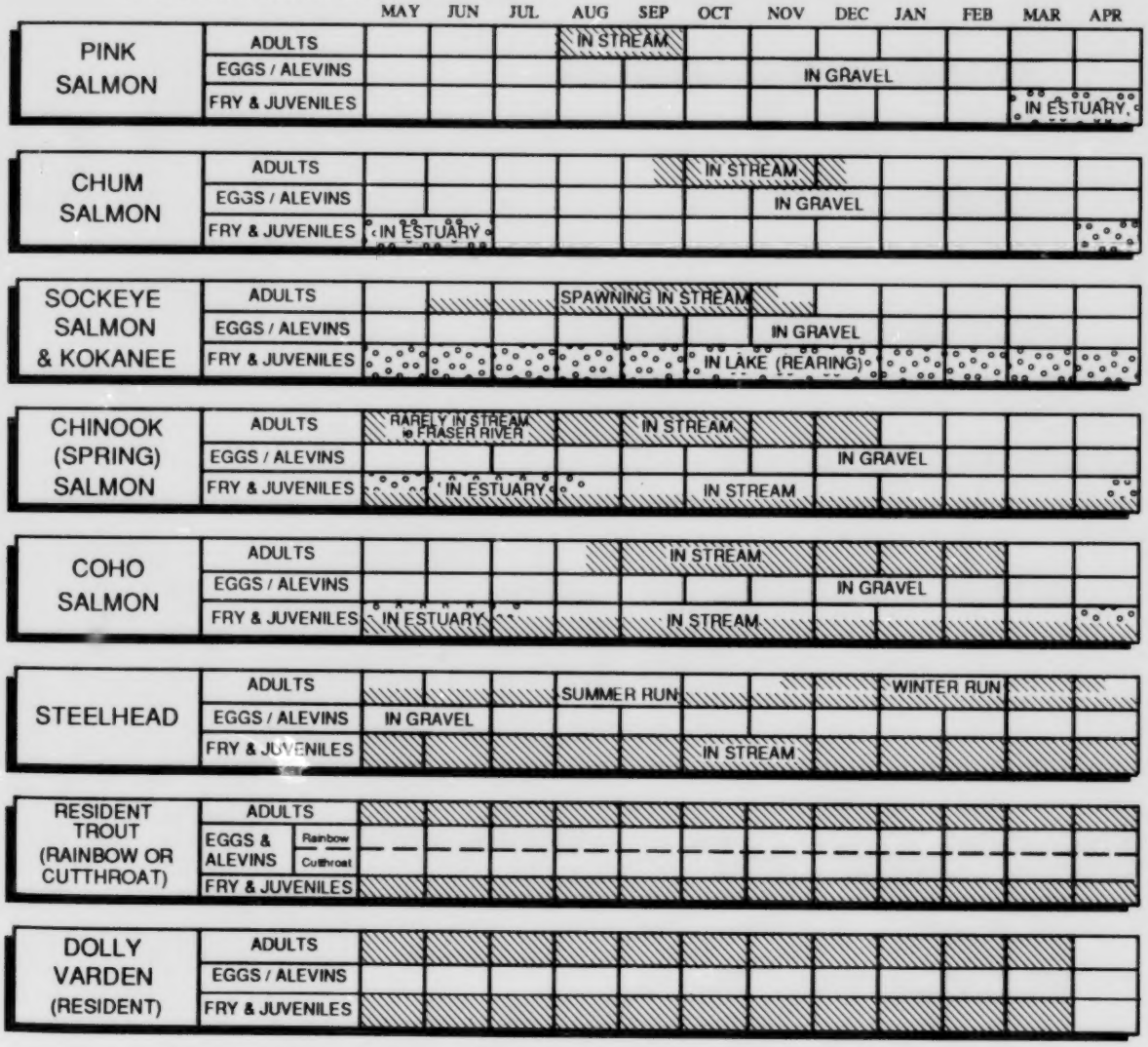
*Note: Possible internal referral to Director at this stage

APPENDIX IIa: General Freshwater and Estuary Residence and/or Utilization for Pacific Salmonids.

APPENDIX II a

General fresh water and estuary residence and/or utilization for Pacific Salmonids

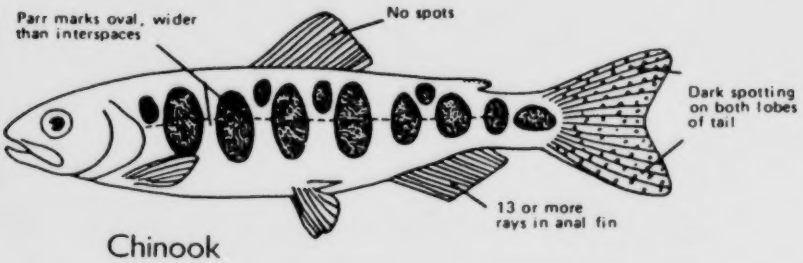
SOUTH COASTAL *
QUEEN CHARLOTTE ISLANDS *
MID/NORTH COASTAL *



* PREFERRED "OPERATING WINDOW" FOR INSTREAM FOREST HARVESTING ACTIVITIES
NOTE: CONSULTATION WITH LOCAL D.F.O. AND M.O.E. STAFF MAY AFFORD SITE SPECIFIC TIMING VARIATIONS FOR INSTREAM ACTIVITIES

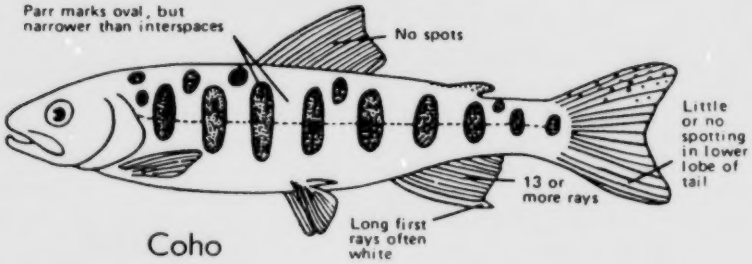
APPENDIX IIb: Identification Features of Juvenile Salmonids

Identification features of juvenile salmonids

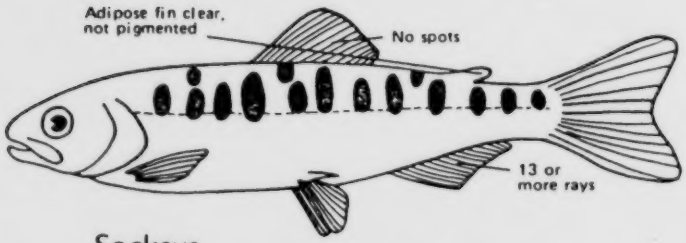


Chinook

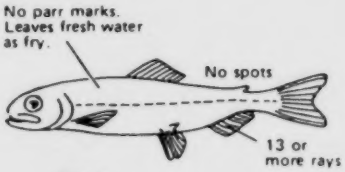
Chum


Parr marks oval, but narrower than interspaces
No spots
Little or no spotting in lower lobe of tail
13 or more rays
Long first rays often white

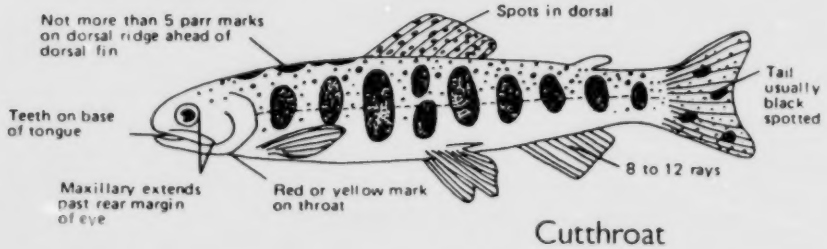
Coho



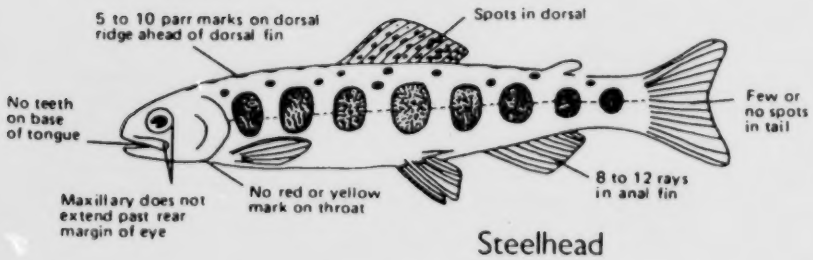
Sockeye



Pink


Not more than 5 parr marks on dorsal ridge ahead of dorsal fin
Spots in dorsal
Tail usually black spotted
Teeth on base of tongue
8 to 12 rays
Maxillary extends past rear margin of eye
Red or yellow mark on throat

Cutthroat


5 to 10 parr marks on dorsal ridge ahead of dorsal fin
Spots in dorsal
No teeth on base of tongue
Few or no spots in tail
8 to 12 rays in anal fin
Maxillary does not extend past rear margin of eye
No red or yellow mark on throat

Steelhead

APPENDIX III: Administrative Arrangements for Implementing Coastal Fisheries/Forestry Guidelines.

APPENDIX III

Administrative Arrangements for Implementing the Coastal Fisheries Forestry Guidelines

Implementation of the Coastal Fisheries/Forestry Guidelines will be coast wide and the first phase will be for a two year trial period. A training program will precede the operational implementation on a phased basis.

The underlying assumption in the implementation is that the forest industry undertakes the initiative in protecting fish habitat as part of its overall responsibility for integrated resource management. Identifying stream reach classes will enable management effort and time to focus on developing prescriptions for priority stream reaches.

The general method for implementation is outlined below:

1. The guidelines will be used by the licencee in the preparation of the habitat component of the Five Year Development Plan. This component includes the identification of all stream reaches into the appropriate classes. The licencee will use data available from the government agencies as well as local knowledge. Preventative or remedial measures consistent with the guidelines, will be prescribed.
2. Unresolved issues will be the subject of consultations with the agencies, including on-site inspection if necessary.
3. Where necessary, site specific prescriptions can be included in the Cutting Permit document or boundary approval documents, whichever is customary in the Forest Region. It is expected that the guidelines themselves would not be appended to these documents, verbatim. More detailed prescriptions specific to the problem site and the individual circumstances, would be used.

1.0 INTRODUCTION

1.1 The implementation of the Coastal Fisheries/Forestry Guidelines is based on three major principles:

1.1.1 The principles, procedures and standards contained in Management and Working Plans apply.

1.1.2 The responsibility for initiating and drafting the plan for the protection of fisheries habitat as a component of a Five Year Development Plan rests with the licencee. The responsibility for final approval of a Five Year Development Plan, after review of the habitat component by the fisheries agencies, remains with the Ministry of Forests.

1.1.3 The classification of stream "reaches" and the incorporation of "reach" objectives form the basis for developing fisheries habitat prescriptions.

1.2 These guidelines apply to all public land forest tenures, i.e. Tree Farm Licences, Forest Licences, and including Timber Sale Licences, managed by the Ministry of Forests. In the case of Timber Sale Licences, The Ministry of Forests, rather than the licencee, is responsible for initiating and referring all forest harvesting plans.

2.0 REFERRAL SYSTEMS

2.1 The referral process presently in place throughout the coastal area will continue and can be adjusted or modified where regional variations dictate or, when agency and forest industry personnel seek better ways.

2.2 Where new policies such as the TFL Subsidiary Agreement are approved, new referral procedures can be implemented as required.

3.0 FIVE YEAR DEVELOPMENT PLANS

3.1 Preparation of the fisheries habitat component of the Five Year Development Plan requires that:

3.1.1 All streams in the area proposed for logging should be mapped and classified to the extent information is available. At a minimum all segments of the area proposed for logging which contain Class I or II stream reaches must be identified on maps. (See Section 5.2)

3.1.2 Where it is proposed to apply forest harvesting treatments to a particular stream reach, and those treatments do not conform with the guidelines established for that reach class, a statement of justification must be provided.

3.1.3 All pertinent resource values must be addressed in the preparation of an acceptable Five Year Development Plan. These guidelines are not intended to infer that other resource values such as wildlife, aesthetics, recreation, forests, etc. are less important than fisheries.

3.2 The licencee has a responsibility to initiate liaison with the B.C. Ministry of Environment, B.C. Ministry of Forests, and the Canada Department of Fisheries and Oceans during the preparation of the Five Year Development Plan.

3.3 The Five Year Development Plan will be referred to appropriate government agencies for review and comment prior to approval by the District Manager of the Ministry of Forests. Every effort will be made to process Five Year Development Plan referrals as quickly as possible.

3.4 The responsibility for final approval of the Five Year Development Plan remains with the Ministry of Forests.

3.5 The licencee is responsible to ensure the plan is implemented as approved.

4.0 SILVICULTURAL PLANS AND OTHER PLANS (i.e. road maintenance plans)

4.1 If requested by environmental agencies, silvicultural plans and other plans will be referred, in accordance with the procedure in Section 2.0 above.

5.0 CUTTING PERMIT APPLICATIONS

5.1 Cutting Permit and final boundary applications will be submitted to the District Manager of the Ministry of Forests and will state the permit is in agreement with the Five Year Development Plan.

5.2 All streams in the area proposed for logging must be mapped into their pertinent reach classes.

5.3 The District Manager will not approve any Cutting Permit not consistent with the approved Five Year Development Plan, without consulting with the fisheries agencies.

5.4 The Cutting Permit or subsequent boundary approval may include site-specific environmental prescriptions if the agencies believe a sensitive situation justifies the inclusion.

6.0 APPEAL PROCESS

6.1 The licencee retains the option to appeal any decision to a higher level in any of the government agencies.

6.2 The resolution of resource conflicts between the three government agencies will be achieved by elevating the issue to the next hierarchial level as outlined in the existing signed agreement between the Ministry of Forest, Ministry of Environment and Canada Department of Fisheries and Oceans (see Appendix I).

7.0 CONTINGENCIES AND LEGAL ACTION

7.1 All parties recognize there will be occasions when natural disaster, unforeseen circumstances or incorrect information renders the approved Five Year Development Plan inadequate or inappropriate. In such cases, the licencee must contact the pertinent agencies or vice versa and arrange to jointly address the problem and amend the plan, as required.

7.2 Where approved management prescriptions and/or contact conditions are not followed, penalties provided in the legislation of the government agencies remains applicable. Nothing in these guidelines waives the application of existing environmental legislation and subsequent legal action, where abuse or omissions occur.

8.0 PUBLIC INVOLVEMENT

8.1 The Ministry of Forests public involvement policies with respect to TFL Management and Working Plans, and Five Year Development Plans, such as public viewing opportunities, etc. remain applicable.

8.2 In addition, the public involvement policies of the B.C. Ministry of Environment and the Canada Department of Fisheries and Oceans will continue to be implemented, as appropriate.

APPENDIX IV: Rationale for Stream Reach Classification for the Guidance of Forest Practices in Coastal British.

CONTENTS

1.0 INTRODUCTION

2.0 DEFINITIONS AND PRINCIPLES

3.0 STREAM CLASSIFICATION CRITERIA AND RECOMMENDATIONS
- 3.1 General Criteria
- 3.2 Specific Criteria
  - 3.2.1 Fish Species Presence
  - 3.2.2 Stream Gradient and Width
- 3.3 British Columbia Stream Reach Classification and Management Objectives
  - 3.3.1 Class I Stream Reaches
  - 3.3.2 Class II Stream Reaches
  - 3.3.3 Class III Stream Reaches
  - 3.3.4 Class IV Stream Reaches

4.0 HABITAT INVENTORY IMPLICATIONS

1.0 INTRODUCTION

The principal objective of the Carnation Creek Follow-up Technical Workshop of April 19-21, 1983, was the revision of existing Coastal Fisheries/Forestry Guidelines. To assist in this task, a committee was appointed to review existing stream classification systems, to recommend a system appropriate for inclusion in the new guidelines and to prepare an associated glossary of terms. The committee was also asked to address issues of stream inventory standards which might be relevant to the classification process.

Information for this task has been assembled from the literature, from discussions at forest harvesting and habitat evaluation workshops and with professional colleagues who deal with fisheries/forestry guidelines. Advice from the Washington State forestry and fishery management agencies has been particularly useful.

The objective of this stream classification procedure is to enable alternate sets of guidelines to be applied to stream reaches with substantially different properties. The acceptance of these stream classes by resource managers assumes the support of the following policy and principles:

1. That fish habitat and stock management objectives differ for the various stream classes, and in particular that some habitats and some populations are of less value than others. These management objectives are detailed in section 3.3.

2. That the basis for classification is the capacity of the stream reach to produce fish.

3. That the divided jurisdiction in responsibility for management of resident and anadromous fish will not affect the classification of stream habitats.

The practicalities of implementing a stream classification system which will be used in the harvesting planning process suggest that data requirements must be simple, well defined and standardized. The stream classification system will, therefore, be evaluated as part of the trial phase of the Fisheries/Forestry Guidelines implementation process to determine how readily data requirements can be met and the effectiveness of the classification system.

2.0 DEFINITIONS AND PRINCIPLES

1. Although we generally speak of streams as whole entities (e.g. the Fraser River), it is clear that the lower reaches (e.g. near Vancouver) have very different properties than upper reaches (e.g. near McBride). Stream classification is thus a classification of stream reaches.

For the purpose of stream classification fairly extensive reaches can be defined, changing only when required by the classification criteria. It must be emphasized that although upstream reaches may be designated at a lower class, their influence on downstream reaches must be considered. This is particularly important in considering the movement of sediment and debris.

2. It is also necessary to distinguish between what is or is not a stream, both for jurisdictional (i.e. institutional) purposes and for ecological clarity. A stream exists when water flows between defineable continuous channel boundaries. These boundaries constitute the streambed and banks which are formed by, and are evidence of, fluvial processes. The stream channel exists whether or not it contains water throughout the year and no matter how small it is. It should be noted that small hillside gullies, although not falling within the definition of a stream, have the ability to trap sediment and debris and release them into the stream.

Many aquatic environments are not properly classified as streams, but may be important or even critical for fishery production. These fishery sensitive zones include estuaries, sloughs, ponds and backchannels of the floodplain, the valley wall ponds fed by upslope seepage, and the seasonally filled depressions providing fish access to and from main channels at higher flows.

3. It is also important to note that although a stream classification has been recommended, that classification is applied to sets of guidelines for activities (e.g. falling and yarding, road building) on land surrounding the streams. The guidelines will always require some fine-tuning to match the characteristics of the land and the influence of those land based activities on the stream environment. Hence, for the application of the guidelines, information about soils, vegetation, windfirmness, climate, and especially terrain, will also be necessary.

4. A very large number of interacting biological and physical processes determine the type of stream present, its capacity to produce fish and its inherent stability. A quantitative assessment of these factors on every site would demand resources which are not available to management agencies at this time. Hence, certain critical factors are usually chosen which provide useful indexes to those processes. Review of existing classification systems (see next section) suggests that the following three are useful for most management objectives.

a. The presence of certain fish species groups
b. The gradient of the stream channel
c. The size of the stream channel, usually indicated by its width.

5. A stream is a downstream continuum. Upstream reaches are most dependent on terrestrial processes for water, nutrient and energy inputs. Downstream reaches are influenced by the products of upstream reaches, as well as by adjacent terrestrial environments.

6. There is a far greater total length of steep, narrow stream habitats than those which are broad or of low gradient. This means that the most commonly experienced management problem or goal will be the prevention of accumulating downstream impacts by maintaining the stability of existing channel networks.

7. Even with the best stream typing information, the classification can only be applied with common sense. Not only do habitat preferences of fish species vary widely, but management policies and exploitation rates may vary the sensitivity of a stream to disturbance. The increasing emphasis being placed on salmonid enhancement (e.g. headwater stocking) in the B.C. coastal region make this particularly important.

8. It is implicit in the following section that water temperature is not a common problem in coastal British Columbia. Exceptions do occur, in which case standard stream temperature management procedures may be necessary to maintain water quality.

3.0 STREAM CLASSIFICATION CRITERIA AND RECOMMENDATIONS

Stream classification systems which are applicable to fisheries/forestry guidelines have been assembled from Washington, Oregon, Montana, Yukon and various British Columbia applications.

3.1 GENERAL CRITERIA

The information reviewed and discussions with resource managers suggest some necessary criteria for classification systems used in guideline processes:

1. They must be clear and understandable to both resource managers and to non-technical interest groups (e.g. loggers, sport fisherman).
2. They must identify both in-stream values and the stream features which activities such as forest harvesting might affect.
3. They must be grouped in classes or ranges of values so that planning and priorization of effort is possible.
4. The classes and associated guidelines must avoid a "cookbook" rigidity, but must provide sufficient management direction and flexibility to allow an experienced manager to reconcile forest harvesting system limitations with stream system requirements.
5. They must be based on data which are usually available or easy to obtain. This criterion is a mandatory prerequisite for the successful implementation of any classification system.
6. Classes must apply to definable stream reaches rather than whole streams.

3.2 SPECIFIC CRITERIA

Three specific criteria recurred in most classifications reviewed: fish species presence, stream gradient and stream width. Although these factors can be used to define a stream class, and hence the management objectives associated with that class, the choice of the most appropriate means to meet those

objectives usually requires some additional information. Soil and slope stability, channel and bank stability, forest type and windfirmness, fishery sensitive zones and the relationship between upstream and downstream reaches will all influence the specific harvesting plan. The influence of these factors on the capability of a stream to transport debris and sediment downstream is of particular importance. These factors have been considered in the development of the Coastal Fisheries/Forestry Guidelines.

3.2.1 FISH SPECIES PRESENCE

All the classifications reviewed used fish species presence as an indicator of stream "value". Correlated habitat parameters such as gradient and width are only used in the absence of good fish data, and are then used to indicate habitat capability (Figure 2). Due to the general lack of detailed fish population data, habitat inferences are frequently necessary in British Columbia. They must be used with caution, however, because of the wide variability in geographic and ecological properties.

Relative abundance or population numbers are difficult to apply on the ground, not only because of lack of data, but also because of a lack of agreement on terms such as "substantial" or "significant". Jurisdictional differences play a role (see Introduction), as well as varying management emphases such as large vs. small river management and hatchery vs. natural/semi-natural production.

The number of species class groupings chosen reflects both jurisdictional concerns and data availability. The major classes distinguished were anadromous, resident sport, non-sport and no fish. It is considered that these distinctions are valid, with provision for upgrading where approved management plans exist. Specific cases where upstream non-sport populations may contribute to downstream managed stocks may require careful evaluation.

3.2.2 STREAM GRADIENT AND WIDTH

Gradient was also commonly referred to as an indicator of stream capability. Although much variability exists between species, it is well documented that fisheries productivity (diversity and density) is higher in lower gradient stream reaches. Some species (e.g. cutthroat trout) have been found in reaches up to 17% average gradient, but were localized in pockets of lower gradient water within the reach (i.e. pools below falls). Figure 1 illustrates the general gradient vs. species trend.

Low gradient streams tend to be located in valley bottoms which also contain the highest value timber sites. Hence, the highest degree of on site habitat protection measures often will be required in areas of highest forest resource values.

High gradient streams, although of relatively lower value for spawning or rearing, have a correspondingly higher capability to transport sediment and debris downstream. The management objective for these streams is to protect downstream anadromous and resident sport fish reaches from accelerated transport of debris or sediment.

While not specific to stream classification it is important to note that in many low to moderate gradient streams, stable in-channel debris holds gravel, provides habitat cover and diversity, dissipates energy and contributes significantly to habitat complexity and fish production. Streams devoid of large stable debris have lower habitat complexity and are less productive.

3.3 BRITISH COLUMBIA STREAM REACH CLASSIFICATION AND MANAGEMENT OBJECTIVES

After reviewing existing classification systems and the stream characteristics previously noted, a four class system has been adopted, based primarily on the presence of fish species groups and secondarily on stream gradient. Gradient and related properties must be included as they are well correlated with fish species, hydrologic and hydraulic properties and sediment and debris transport capability. As was mentioned above, it is necessary to couple the stream class with other land or watershed characteristics (e.g. soil erodibility and terrain) to determine which protection measures are required for the class selected.

In the absence of fish species data, the gradient classes of 0-8, 8-12, 8-20 and greater than 20% are used as class indicators.

The use of this classification system is predicated on a set of objectives associated with each stream class which provide criteria for choosing specific guidelines and a basis for evaluation of performance.

3.3.1 CLASS I STREAM REACHES

Anadromous salmonids or moderate to high levels of resident sport fish are present,[1] or the reach has been identified for upgrading in an approved fisheries management plan. Stream gradient is usually less than 8%.

Objective: Maintain productive capacity of fish habitats. This specifically requires measures which will

1. Maintain water quality.

---

[1] Fish presence may be for only one life history phase (e.g. spawning, overwintering).

2. Maintain the integrity of stream channels and banks.
3. Maintain the quality of streambed gravels.
4. Maintain the adjacent source of fish food producing material and organisms for the stream.

To meet the objective for Class I streams, it may be necessary to design compensating or mitigating measures which offset the unavoidable effects which even careful forest harvesting may have on a stream system.

3.3.2 CLASS II STREAM REACHES

Low levels of resident sport fish are present. Stream gradient is usually 8-12%.

Objectives: Minimize loss of productive capacity of fish habitats and maintain sufficient stream channel integrity to protect Class I reaches from accelerated transport of sediment or debris.

3.3.3 CLASS III STREAM REACHES

Resident non-sport fish are present. Stream gradient is usually 8-20%.

Objectives: Maintain the genetic stock of indigenous species. Some permanent reduction in stock size or in-stream habitat may occur providing that necessary life processes are maintained and sufficient stream channel integrity is maintained to protect Class I and Class II reaches which may be impacted from accelerated transport of sediment of debris.

3.3.4 CLASS IV STREAM REACHES

No fish are present. Stream gradient is usually greater than 20%.

Objective: Maintain sufficient stream channel integrity to protect Class I and Class II reaches, which may be impacted from accelerated transport of sediment or debris.

4.0 HABITAT INVENTORY IMPLICATIONS

Stream habitat information sufficient to enable the application of this classification requires, at a minimum, the determination of fish species presence, stream gradient and management objectives for each reach of stream being classified. This information is, or will be, generally available from fisheries agencies.

If any group is planning for additional or new inventory, they are strongly recommended to contact designated representatives of the Federal/Provincial Habitat Inventory and Information Program to ensure that existing information has not been overlooked, and that compatible methods are used.

Field inspections to verify stream classes, if required, offer an opportunity to supplement the elementary data mentioned with additional population or habitat information. This additional information may identify opportunities to make considerable refinement to harvesting guidelines, and potentially to increase or maintain fish production while maintaining or lowering forest harvesting costs. Close cooperation between all resource specialists is encouraged.

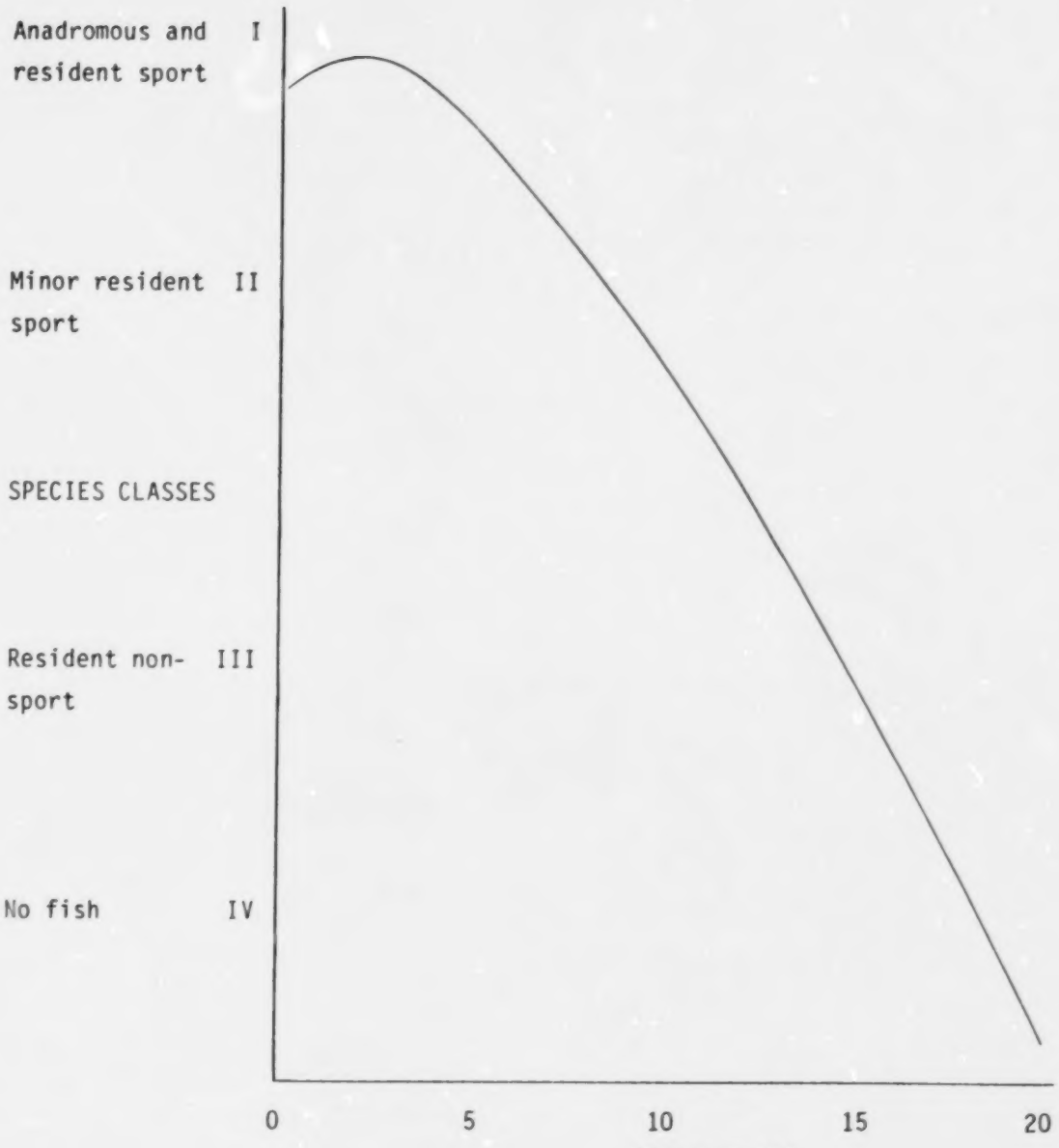
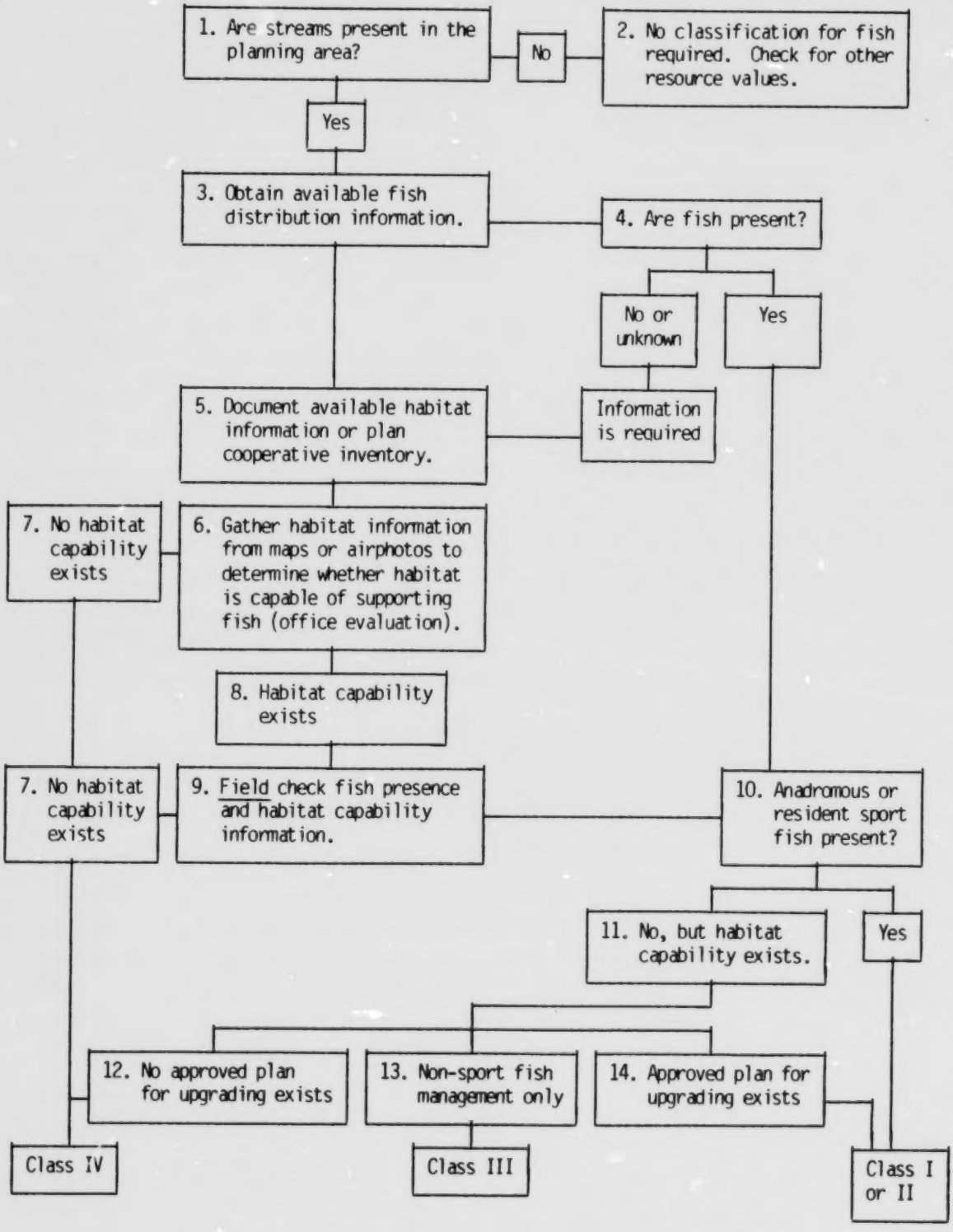


Figure 1 ... Generalized relationship between species classes and stream gradient Regional and species specific differences may apply.

Figure 2

STEPS FOR STREAM REACH CLASSIFICATION


1. Are streams present in the planning area?
No
2. No classification for fish required. Check for other resource values.
Yes
3. Obtain available fish distribution information.
4. Are fish present?
No or unknown
Yes
Information is required
5. Document available habitat information or plan cooperative inventory.
7. No habitat capability exists
6. Gather habitat information from maps or airphotos to determine whether habitat is capable of supporting fish (office evaluation).
8. Habitat capability exists
7. No habitat capability exists
9. Field check fish presence and habitat capability information.
10. Anadromous or resident sport fish present?
11. No, but habitat capability exists.
Yes
12. No approved plan for upgrading exists
13. Non-sport fish management only
14. Approved plan for upgrading exists
Class IV
Class III
Class I or II

APPENDIX V: Engineering Specifications for the Planning, Design, Location, Construction and Maintenance of Logging Roads and Drainage Structures.

File: _____

Date: _____

Road Class: _____

BRITISH COLUMBIA FOREST SERVICE
ENGINEERING SPECIFICATIONS FOR THE PLANNING, LOCATION, DESIGN CONSTRUCTION, MAINTENANCE AND DEACTIVATION OF LOGGING ROADS AND DRAINAGE STRUCTURES IN THE VANCOUVER FOREST REGION

A. Engineering Policy

A.01 With due consideration for the protection of soils, site productivity, fisheries, water quality, other resource values and for the appearance of forest landscapes in visually sensitive areas, the location and design (alignments and gradients) of all logging roads including skid and back spar trails and drainage structures shall be such that the combined costs of construction, log hauling, maintenance, safety requirements, avoidable site degradation remedial prescriptions and deactivation are minimized. Competent personnel utilizing accepted engineering principles shall be employed in the planning, location, design, construction, inspecting, maintenance, repairs and deactivation of all works.

The latest versions of the B.C.I.T. Manual for Roads and Transportation (I and II), the F.E.R.I.C. Log Bridge Construction Handbook or other specified Forest Service publications are the references for accepted engineering principles.

A.02 The amount of road and trail built shall be minimized in conjunction with logging layout.

Avoid locating roads through unstable areas, other areas sensitive to road construction and wherever other resources are threatened.

If it is deemed necessary to traverse such areas then site specific survey, design and construction techniques shall be proposed by _____ for the review and approval of _____.

A.03 When construction is finished, maintain the road surface for economical hauling, ditches and culverts for efficient drainage and bridges for safe carrying capacity. Brush and debris are to be removed from the right-of-way as required for safe visibility.

Protect the road bed from erosion caused by water emanating from snow banks left from snow plowing. Crown the road surface or construct swales or waterbars.

A.04 Traffic control devices and kilometer signs shall be located and installed as required.

A.05 The Licensee is responsible for reviewing these specifications with all his employees and contractors associated with road work.

A.06 All roads, skid and back spar trails shall be deactivated after logging use in accordance with Part H unless otherwise directed by _____. If practical this will be done in such a manner to provide two or four wheel drive access.

A.07 All roads are subject to the various applicable Acts and Regulations.

The following specifications may be modified or amended only with the approval of _____. Design and/or construction prescriptions may be added to meet unusual or special conditions.

B. General Road Construction Specifications

B.01 Right-of-way Clearing, Grubbing, and Slash Disposal:

01. Fall all trees within the right-of-way area 3 meters beyond the top of cuts, and 3 meters beyond the toe of fills unless increasing or decreasing this width will increase the stability of cut or fill slopes or improve aesthetics. Any such deviation requires the approval of _____.

    Fall leaners and damaged trees adjacent to the right-of-way and yard these together with any trees that were felled into standing timber into the right-of-way.

02. Recover and protect merchantable logs prior to subgrade construction. Logs may be used for road punching, culverts and bridges providing their use is economical and prior approval has been given by _____.

03. Remove stumps and organic soil as dictated by depth of overburden, sideslopes and centreline cuts. For overlanding the site may be left in its natural state.

04. Treat clearing slash and non-merchantable wood by scarifying, burying, burning or as directed by _____.

B.02 Subgrade Excavation:

01. Ensure adequate drainage is provided and maintained during the subgrade excavation stage and is fully functioning for periods of temporary or seasonal shutdowns.

02. Drill and blast rock in a manner that minimizes damage to standing or felled timber, growing sites and other resources.

03. In unstable rock formations take the necessary precautions (i.e. choice of blasting agents, drilling patterns, size of blast, professional advice, etc.) to prevent initiating slides or slope instability.

04. Design and construct cut and fill slopes to suit the local soil and rock types. Cut slopes must minimize the combined costs and effects of ditch maintenance, erosion and site disturbance. See attached FS650.

    Avoid creating concave shaped cutslopes and round off the tops of cuts.

05. Adopt measures to stabilize or protect cut and fill slopes where instability or erosion problems exist.

06. Sidecasting onto or into:

    a) plantations
    b) aesthically sensitive slopes
    c) unstable slopes
    d) gullies
    e) private properties
    f) other problem slopes or areas
    g) any body of water

    is not permitted unless approved by _____. Site specific constraints will be issued or approved by _____ for the removal and deposition of the excavated material within such areas and any remedial measures that are required.

07. Balance cuts and fills where possible and utilize subgrade material for fills, ballast or surfacing wherever practical.

B03. Ballasting and Surfacing: Place sufficient ballast or surfacing material to carry loaded (design load) logging trucks, and other logging equipment without detrimental rutting or deforming the road surface. Give due consideration to the planned traffic frequency, quality of ballast and surfacing materials, and required maintenance.

B04. Turnouts: Locate turnouts to augment safe, economical hauling. Generally, roads having high density traffic require intervisible turnouts 8 to 10 meters wide including the road, and a useable length of 30 meters.

B05. Widenings: Widen all curves to allow for side tracking of truck-trailer units. Widen blind curves or provide safety measures (i.e. sign posts, turn-outs, radio call out messages) commensurate with the existing hazard, economics and site impact requirements.

B6. Provide sight and stopping distance at all road junctions commensurate with grades, alignment and traffic density. The ideal junction provides a stopping distance and a clear view in both directions for the truck entering the mainline.

C. Pits and Quarries

Obtain approval of _____ for pits and quarries that will extend beyond the right-of-way boundaries. Clear the pit area and dispose of slash as per B.01. Dress the slopes to a natural angle of repose before abandoning the pit if deemed necessary by _____.

D. Drainage Structures (Bridges, culverts, fords and ditches)

Design and install or construct all drainage structures in accordance with accepted engineering principles to carry the design load and pass the specified peak flood. Incorporate measures to pass or trap debris and clean-out such traps as required.

Ensure that other resource agencies concerns have been incoporated into the design.

D.01 Bridges

Bridges are defined as structures over 6 meters in span.

Locate, design and construct bridges which will pass the designated flood and anticipated debris for the following:

01. the 100 year flood when bridge materials are glulam, concrete or steel (i.e. permanent) or logs if specified by _____;

02. the 50 year flood for log bridges over major tributaries;

03. for all other tributaries pass the 25 year flood;

04. minimum clearance to be 1 meter above design high water;

05. satisfy site specific constraints to limit scour, siltation and erosion and minimize debris build-up;

06. satisfy timing constraints for construction.

All bridges shall be maintained commensurate with use. They shall be regularly inspected to determine load capacity rating. The determined capacity rating, if less than the maximum loads expected, shall be posted.

Ministry drawings for "Typical Log Bridge Type A or Type B are available from Forest District Offices. Drawing numbers are 129 P18 1-1 or 4-238-1 of 1.

D.02 Culverts

01. Select culverts with enough capacity to pass the 50 year flood on main roads and the 25 year flood on the other roads at HW/D=1.0. Install metal culverts in accordance with manufacturer's specifications. Culvert installations for flows over 6 m^3/sec or sizes over 1800 mm in diameter must be structurally designed.

02. Install culverts as required to ensure the natural drainage pattern of all continuous and seasonal streams is maintained. Install additional culverts as necessary to drain ditches and minimize ditch erosion. Provide temporary culverts or cross drains (fords) as required during the pioneering stage where siltation or erosion will have adverse impacts on other resources and on the stability of the road.

03. Install metal, plastic or cedar culverts on roads which will be used for log hauling for more than 10 years unless otherwise approved by _____. Other wood species may be permitted on shorter term roads.

04. When designing ditches and cross drains consider gradient, alignment, required flow capacity, site exposure, cut slope height and steepness, soil erodibility and the location of the outflow. Skew cross drains to the road's centerline 3 degrees for every 1% of road grade over 3% (i.e. road grade is 16%, culvert is (16-3)*3 = 39 degrees. Install ditch blocks as required.

05. Position culverts on the line and grade of the original channel if feasible and minimize disturbances to the stream banks.

06. The depth of fill over metal or plastic culverts is the greater of 300 mm or one-half the pipe diameter.

07. Minimum culvert sizes: 500 mm in diameter for pipes; and 1 m * 0.5 m for logs unless otherwise approved by _____.

08. Fords may be installed where approved by _____ and require the same considerations mentioned in D.02.-.04.

09. Provide adequate drainage at all road junctions.

10. Replace or protect unstable fill at culvert outlets with a non-erodible material. Protect inlets as required.

Adopt as part of the regular maintenance program, the inspection and maintenance of drainage structures both seasonally and/or annually, particularly during and after major storms and at the completion of yarding and loading operations.

E. Special Provisions for the Maintenance of Water Quality

E.01 Where it is necessary and feasible, install cross drain culverts to divert ditch water away from sensitive areas. Otherwise, catchment basins may have to be constructed and maintained to ensure water quality.

E.02 Plan borrow pits and waste areas to minimize erosion.

E.03 Do not dump or spill material, including road excavation material, in any body of water unless such material forms the base for the subgrade and is approved by _____.

E.04 Suspend any road building operation causing damage through erosion or siltation, especially during period of intensive rainfall or heavy runoff or when soils are saturated.

E.05 For excavator construction on easy slopes, increase the cleared width to provide for spreading of unuseable material. Such material is to be spread to keep depths minimal and must be suitably placed and protected to minimize erosion.

E.06 When forest operations are finished, or annually, if necessary, either maintain roads and drainage structures to ensure they are environmentally safe or deactivate them by removing culverts and temporary bridges and construct water bars such that the drainage pattern is maintained. Refer to Part H.

E.07 Special construction techniques and use of special excavating equipment is required on a site specific basis. For example, excavators are to be used for poorly drained soils.

E.08 Maintain the road to prevent accelerated erosion and water quality degradation. Crown or slope roads to prevent the accumulation of surface water. Remove all berms unless they are designed for a specific purpose. Provide swales or waterbars to drain road surface water emanating from snowbanks resulting from snowplowing operations.

E.09 Keep culvert and bridge sites clean during and after construction.

F. Special Provisions for Protection of Fish Bearing Waters

F.01 Obtain the approval of _____ for the location, timing and method of construction of all structures proposed over fish bearing streams.

F.02 Protect the shorelines of streams and lakes and shoreline shrubs from damage due to road right-of-way activities (clearing, road construction, logging and burning) as specified by _____.

G. Skid Roads and Back Spar Trails

G.01 Back Spar Trails

.01 Such roads or trails are to be marked on the ground and require approval from _____ prior to construction.

.02 Locate, construct, maintain and rehabilitate such roads and trails to minimize erosion, siltation and site damage.

.03 Construction and use of such roads is limited to drier parts of the year or suitable protection measures are incorporated to minimize site damage (i.e. ballasting with rock, slash, corduroy, etc.).

.04 All continuous and seasonal streams are to have drainage structures as approved by _____. They may be culverts or fords designed to pass the maximum anticipated flood. Culverts are to be removed upon annual and/or final cessation of logging and the channel restored to it's original nature. Cross drains, either culverts or fords, are to be installed as necessary.

.05 Creek crossings are to be located at approximate right angles to the flow and are to be treated to prevent sediment from entering into their waters.

.06 Such roads shall be outsloped unless directed otherwise by _____.

.07 All phases of construction are to be completed concurrently unless otherwise approved by _____.

.08 All equipment is confined to the trail or as authorized by _____.

.09 Rehabilitation measures for such roads will be determined and approved by _____ and completed in advance of equipment leaving the site. These measures may include replacement of excavated material, ripping, tilling, other decompaction measures, establishment of vegetation, ditching, or other methods as deemed necessary by _____.

G.02 Skid Roads

All of G.01 and:

.01 Skid roads are to be located across slopes rather than directly up or down the slope.

.02 Skidders are not to be operated under weather or soil moisture conditions which will degrade the site or adversely affect other resources.

H. Deactivation of Roads, Skid Trails and Back Spar Roads

H.01 All roads no longer required for logging or other uses shall be deactivated, rehabilitated or put back into production utilizing techniques described below or others as deemed necessary or prescribed by _____. _____ will identify which measures are to be undertaken annually.

H.02 Planning Requirements

Each area proposed for development shall have an access map clearly showing the roads to be:

.01 left open for hauling or two wheel drive access;

.02 left open for four wheel drive access;

.03 closed temporarily;

.04 closed permanently.

Planned deactivation work is to be shown as marked in the field on the approved cutting permit (logging) map and submitted to the _____ two months prior to the planned end of harvesting activities and indicate:

.01 location of bridges and culverts to be removed;

.02 location of all waterbars;

.03 location of other remedial works and a brief description of such work;

.04 proposed timing of planned works.

Regardless of the end use of the road, the above plan along with the planned deactivation work must be approved by the _____ prior to undertaking the work. The _____ will prescribe deactivation work if none is proposed by the Licensee (Permittee).

Failure to comply with the approved deactivation plan will result in the Forest Service doing the work at the Permittee's expense.

The following can be used as a guideline by personnel having knowledge of the area to be deactivated and have demonstrated experience in deactivation-rehabilitation work.

H.03 Waterbar Guidelines

The intent is to space waterbars to limit the amount of water or velocity build-up and minimize erosion. Ideally ditch or road surface water is to be either directed back into it's natural drainage pattern, or gullies or it is to be dispersed as quickly as practical. Avoid directing water onto unstable or erodible fills or towards other sensitive sites.

Planning

.01 mark water bar locations in the field with ribbons on both the cut and fill side of the road;

.02 number or letter the ribbons in an orderly fashion;

.03 show location of ribbons on the cutting permit map;

.04 include notes outlining other required work at or between the ribbons (i.e. insloping, outsloping, berms, etc.)

.05 date and sign the plan and submit to _____ for review and approval (at least 60 days prior to the end of the planned use of the road).

The following table can be used as a spacing guide but must be modified to suit other parameters as found on each individual road section.

H.04 Waterbars are to be constructed in accordance with the specifications shown on Sketches 1, 2 and 3. The following Waterbar Spacing Tables are to be used as a general guide for their spacing.

H.05 Unless otherwise instructed by _____, all bridges and culverts shall be removed in accordance with Sketches 4, 5 and 6.

H.06 Although outsloping is most effective for contour roads, it can be used for any road in conjunction with waterbars and/or swales. See Sketch 7.

H.07 Insloping is used to keep road and ditch water away from the fill side of the road. See Sketch 8.

H.08 Berms may be required to keep water away from the fill side of the road or can be used to direct water towards a desired location. See Sketch 9.

H.09 In some situations, the road or trail may require the following measures to either reduce instability or erosion problems or to put the area back in production.

.01 excavating the fill back onto the road bed;

.02 ripping or tilling to reduce compaction;

.03 revegetating.

Such measures will be prescribed on a site specific basis by _____ and form part of the deactivation plan.

H.10 Roads to be left open for two or four wheel drive must be maintained.

WATER BAR SPACING GUIDE FOR ROADS
AND SKID AND BACK SPAR TRAILS IN METERS

Soil Type / Road Gradient	Silts and Fine Sands	Coarse Sands and Cohesive Clays	Gravels and Rock Ballast
0-5	100	160	210
6-10	80	110	160
11-15	50	90	130
16+	Site Specific		

This spacing must be modified for slope position and side slope steepness as follows:

CORRECTION FACTORS

Slope Position	Sideslope (%)				
	0-20	21-40	41-60	61-80	81+
Upper Slope	1.0	0.8	0.7	0.6	0.5
Middle Slope	0.8	0.7	0.6	0.5	0.4
Lower Slope	0.7	0.6	0.5	0.4	0.3

See Notes on Page 11.

Note:

1. To use the tables:

   a) Divide road into sections of similar grades, soil types and slope.

   b) Measure the average road gradient in percent.

   c) Visually estimate the soil type in the ditch and on the road surface. Choose the spacing required for the most erodible soil if ditch and road surfacing material differ. Erodibility generally decreases thusly:

      Silt -- Fine Sand -- Sand -- Clay -- Gravel -- Cemented Material -- Coarse Gravel.

   d) Choose the slope position.

   e) Measure the average sideslope for the road section.

   f) Choose the basic spacing from the road gradient and soil type and multiply it by the appropriate correction factor.

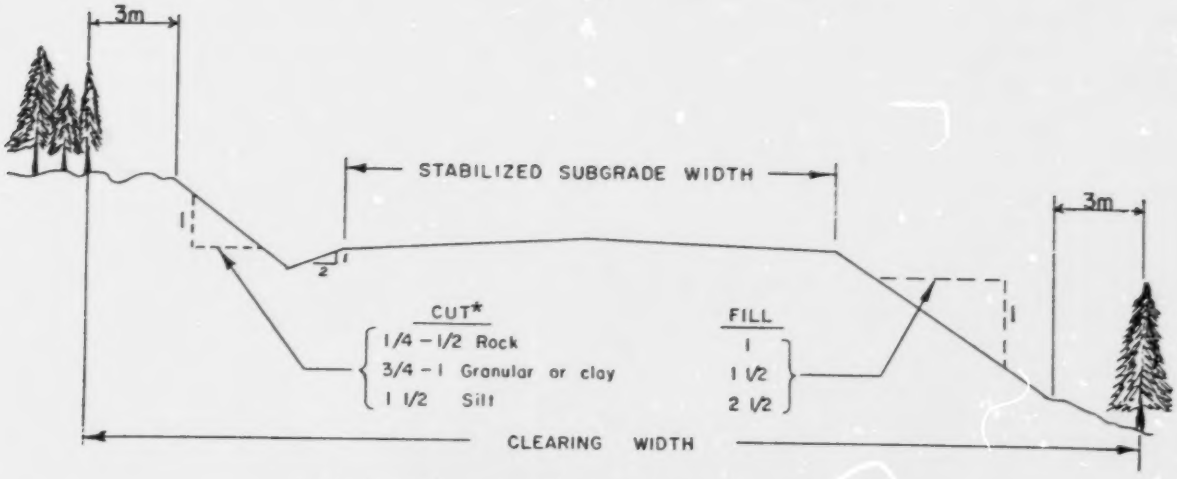
   Example: Silt soil, road gradient 15%; side slope 60%, middle slope. Water bar spacing should be about 50 * .6 = 30 m. This can be considered the maximum spacing.

2. Soils are identified by visual estimate and are classified to the higher percentage of the grain size present. If a soil is estimated to contain 20% silts and sands and 80% rock ballast, then use the spacing for gravels and rock ballast.

   Examine the downslope on which the water bar will disperse water. If extensive erosion will occur, change the location to suit the situation or provide suitable protection. It is better to have several small waterbars rather than a few large ones.

3. It is often possible to deactivate a road and still have two wheel or four wheel drive access.

Roadway Cross-section



STANDARD DIMENSIONS IN METRES

ROAD CLASS	STABILIZED SUBGRADE WIDTH	DITCH DEPTH	CLEARING WIDTH
CLASS 1	10	1.0	35
CLASS 2	9	1.0	30
CLASS 3	8	1.0	30
CLASS 4	6	0.7	25
** CLASS 5	5	0.5	20 **
CLASS 6	4	0.3	20

** Maximum width of road permitted unless otherwise approved by _____.

Local variations in the standard road dimensions are frequently required because of the following circumstances:

a) Clearing width - may be increased or decreased to suit local conditions or particular requirements.

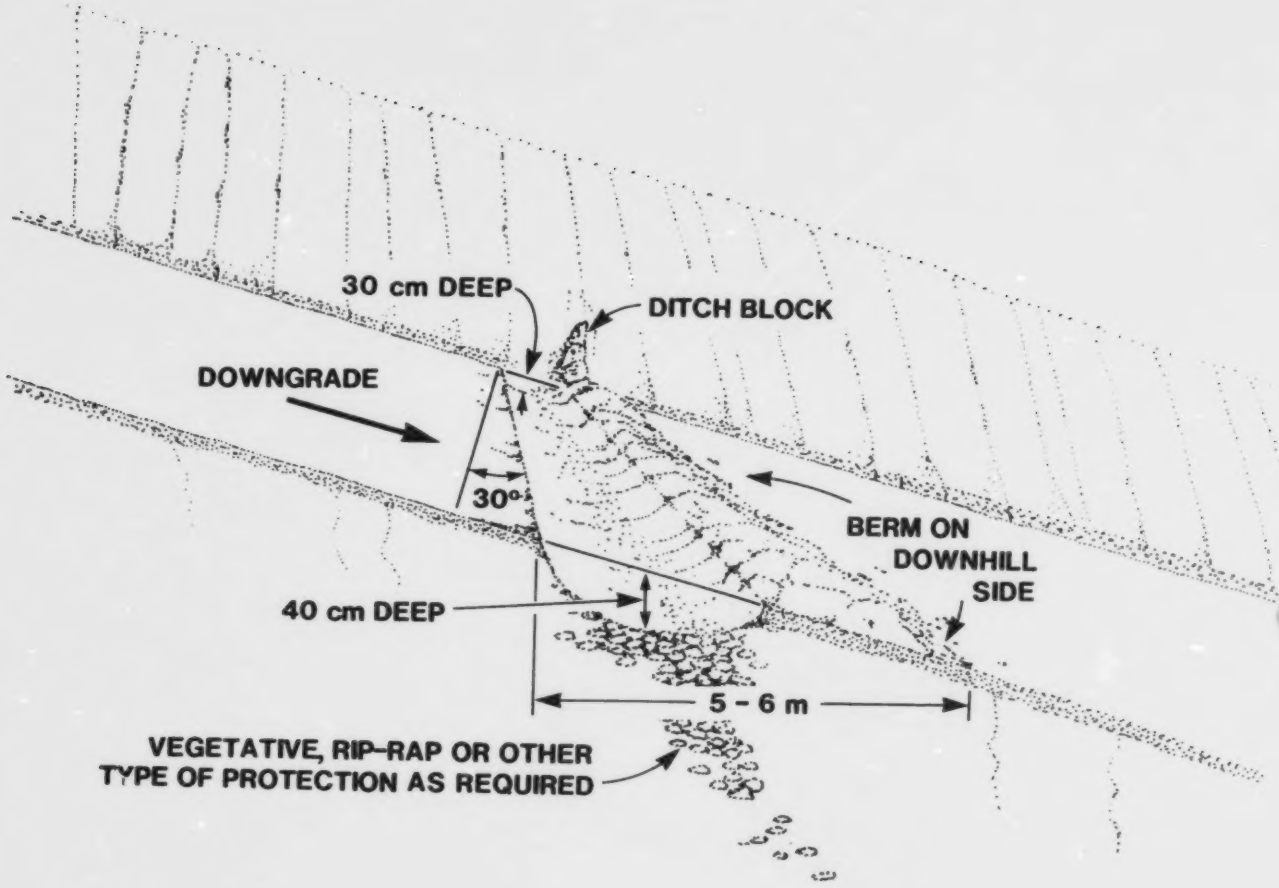
b) Subgrade width - may be increased for turnouts and widenings or decreased in rock cuts.

c) Ditch depth - may be increased to facilitate adequate ditch gradients, or for drainage of unusually wet soil. Depth may be decreased in rock or hardpan sections. In flat country, scraper ditches approximately 4 m wide may be constructed to obtain material for raising the subgrade above the general ground level.

* d) Cut slopes may be increased or decreased to suit soil types and the type of road being constructed (permanent or temporary).

SKETCH #1

Typical Waterbar

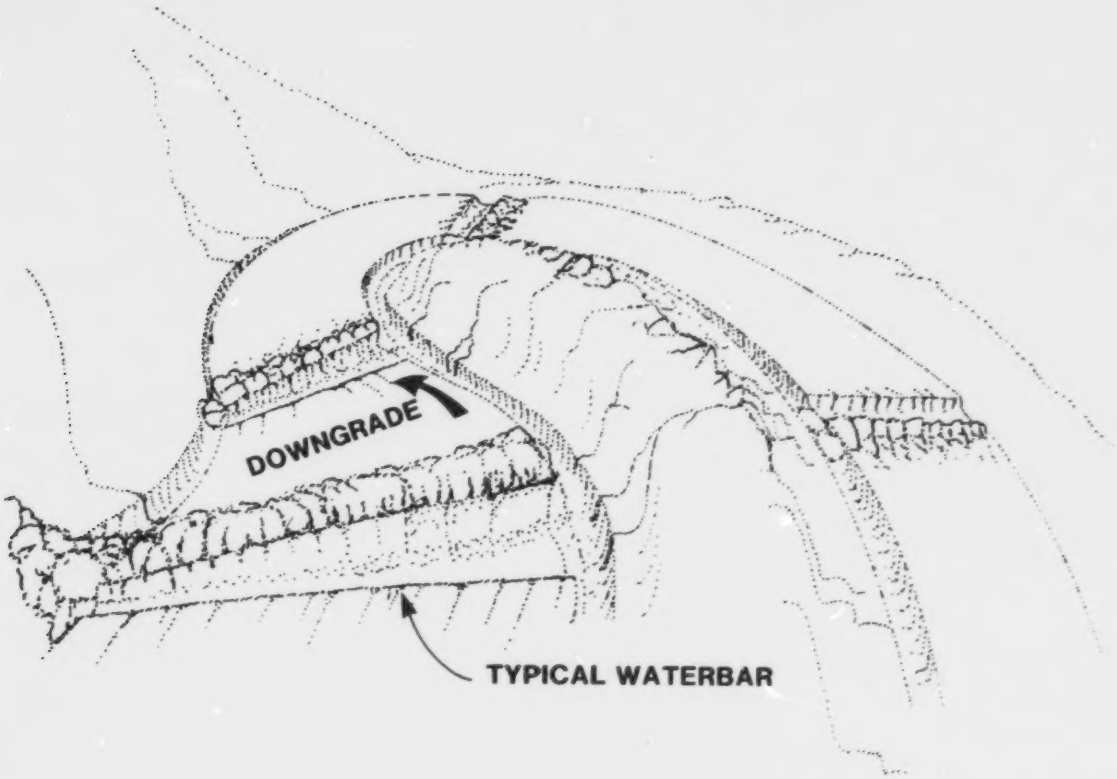


NOTES

- angle 30 degrees as shown.
- ditch block.
- berm on downhill side.
- vegetative or rip-rap protection at outflow.
- driveable with 2WD.
- inlet about 1 m wide; outlet about 3 m wide (as measured on the inside of the waterbar).
- can be constructed by hand, grader, bulldozer, backhoe or other equipment with a blade or backhoe.
- compact the berm to facilitate vehicle passage.

SKETCH #2

Waterbarring Thru-Cuts & Switchbacks

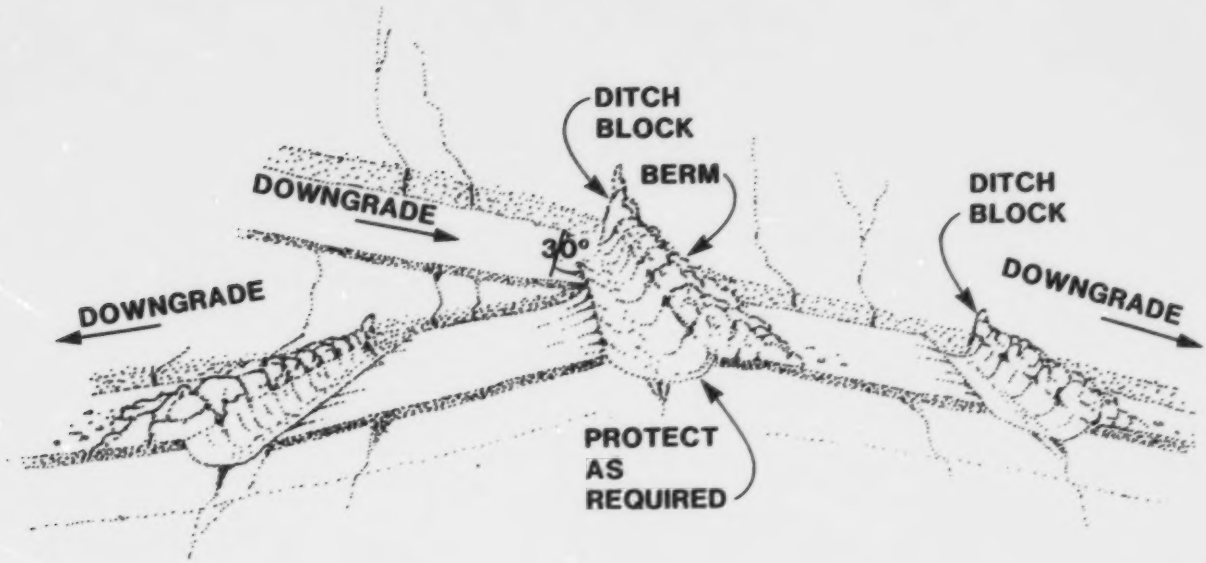


NOTES

- can be one of the worst erosion potentials.
- place waterbar before the start of the thru-cut if feasible.
- place waterbar where thru-cut ends if feasible.
- it may be necessary to waterbar within the thru-cut because of difficulties to maintain ditches.
- crown, inslope or outslope, to keep water in the ditches.

SKETCH #3

Waterbarring Road Junctions



NOTES

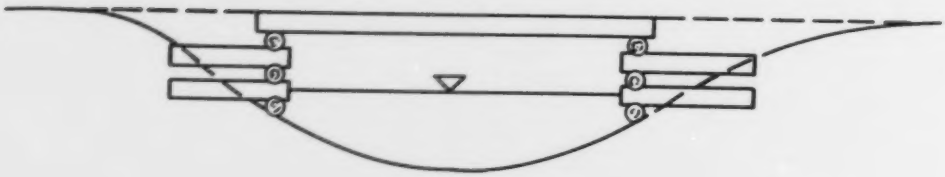
- dimensions the same as for typical waterbar.
- can be driveable.
- ditch block

There are several combinations of junctions, each requiring their own drainage solution. Always consider ditching, ditch blocks, skewing, depth, spacing of bars and outflow protection needs.

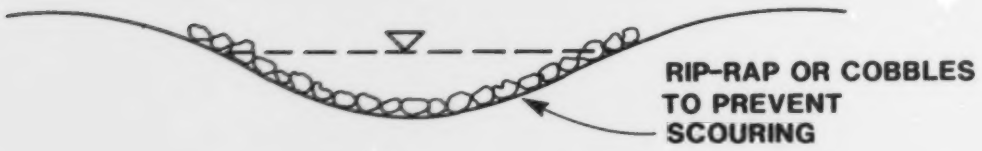
SKETCH #4

Removal of Bridges

Either remove and block the road or construct a ford.



Remove stringers and crib logs and excavate back to original ground line, or leave crib logs in place and construct a by-pass.

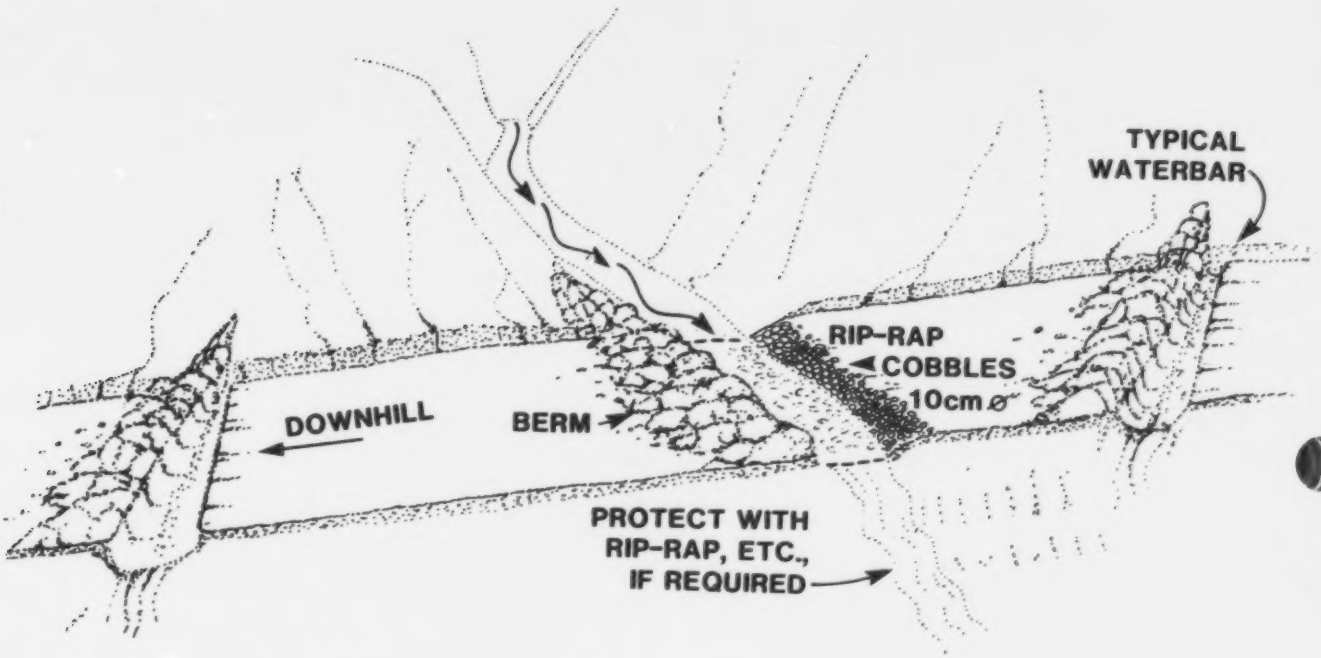


NOTES

- if required for 2WD or 4WD, slope into and out of creek must be gentle enough (less than 30%) to allow passage of vehicle .
- only certain sites are suitable for this solution.

SKETCH #5

Removal of Culverts for Small Streams (Seasonal or Continuous) and Gullies

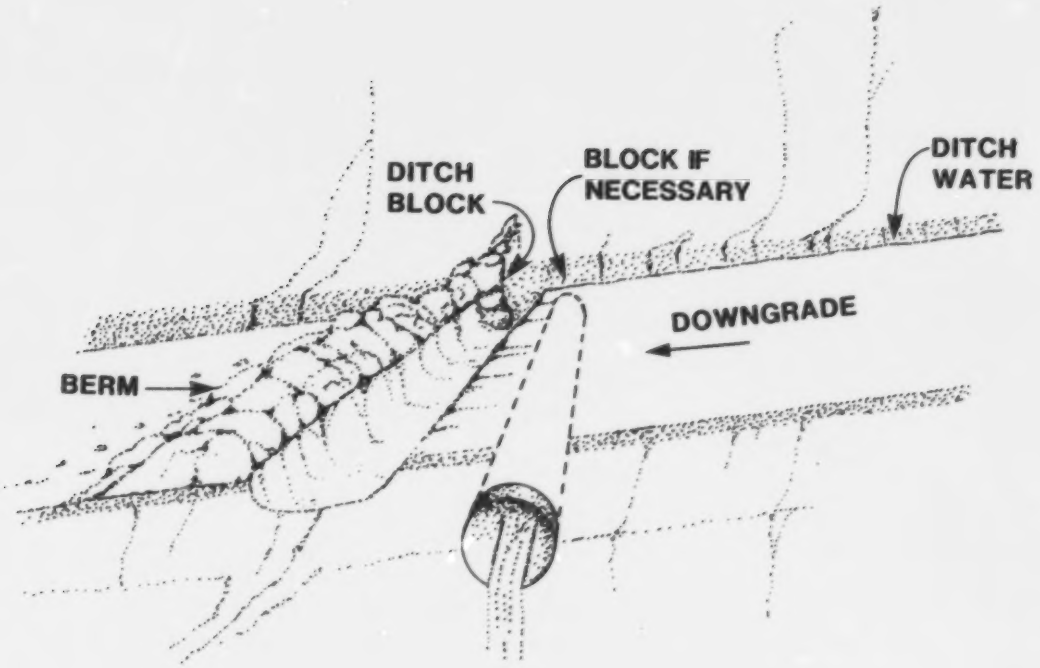


NOTES

- rip-rap in creek channel to minimize erosion.
- can be constructed to allow 2WD and 4WD traffic.
- place waterbar above to avoid carrying sediment into ford.
- place berm large enough to protect against water jumping the bank and running down the road.

SKETCH #6

Removal of Culverts Used For Road and Ditch Water

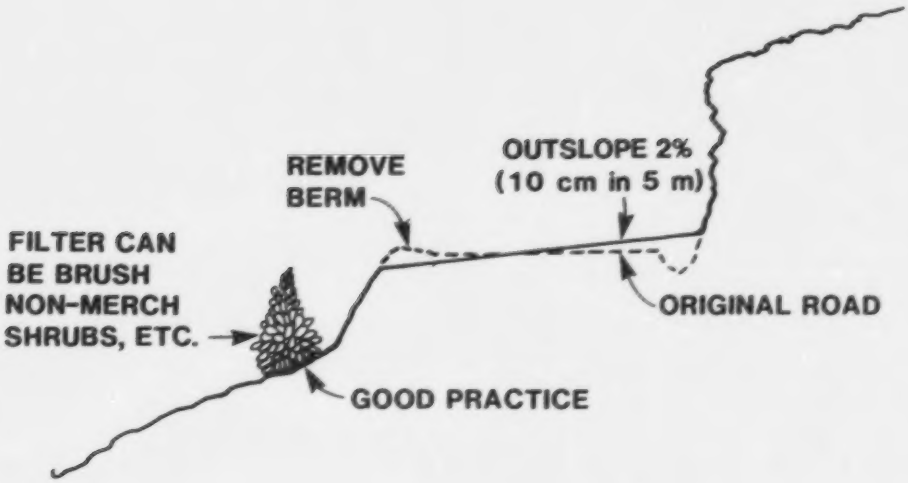


NOTES

- culvert can be left in place if road will be used again in two years or less. Otherwise remove it and construct a typical waterbar.
- usually leave culvert working and place a waterbar downgrade to guard against culvert plugging.
- remember to block the culvert if necessary.
- construct typical waterbars as necessary.

SKETCH #7

Outsloping

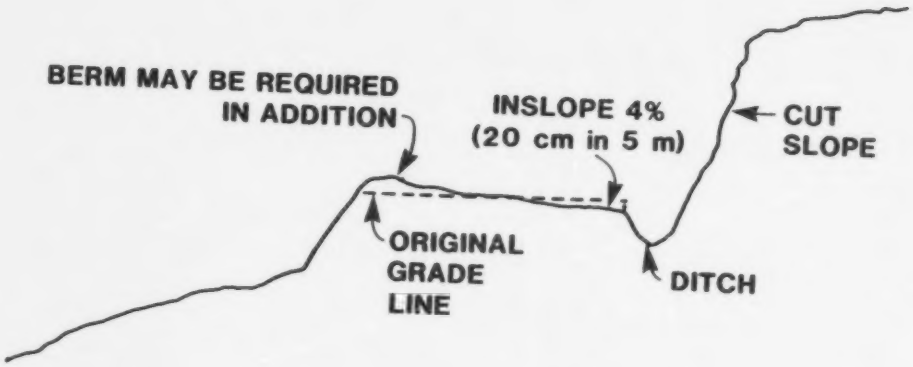


NOTES

- good for contour roads having gradients of less than 5% and ground slope less than 20%, and for roads having no ditches, or ditches subject to plugging.
- waterbars still required.
- if the road is left open for use, then outslope should be increased to 4% (i.e. 20 cm in 5 m).

SKETCH #8

Insloping

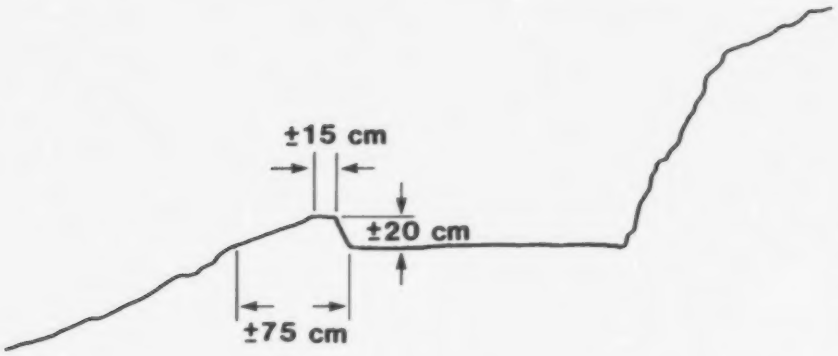


NOTES

- used to keep water away from unstable fill slopes.
- ditch and cut slope must be stable.
- used for short sections of road.

SKETCH #9

Berms



NOTES

- used to keep water away from unstable fills.
- must provide break in the berm at non-problem areas to let water off.
- berms may require removal upon deactivation of the road.
- can be used in conjunction with insloping.

APPENDIX VI: Guide for Aerial Applications of Pesticides in B.C.

Pesticide Control Branch
Ministry of Environment

Guidelines for Aerial Applications of Pesticides in B.C.

Introduction

The following guidelines consist of a simple checklist which the Ministry of Environment expects any person to follow in any aerial application of pesticides. The purpose of these guidelines is to ensure that all pesticides applied by air are applied safely to maximize the deposit within the target area and to minimize the possible deposit outside the target area.

Problem

Spray drift is the movement of the finer droplets in a spray cloud out of the target area and the deposit of these droplets into non-target areas. Spray drift is the main problem arising from the aerial application of pesticides and only rarely is it a problem with ground applications.

Solutions

The solutions to the problem of spray drift involve the selection of various forms of methods, equipment, and activities.(Additional problems and solutions would be involved in the transportation, mixing/loading, storage, disposal, and cleanup related to aerial pesticide operations).

(It is assumed that the decision for selecting an aerial method of application instead of other methods has already been made at an earlier stage).

1. Pesticide

   Select a pesticide which is registered for aerial use and select a formulation which has been designed to reduce vaporization (volatility) and spray drift. Select an appropriate drift control agent, if required. Select appropriate equipment and personnel if some of the mixing must be done on location at the airstrip to ensure proper mixing and to minimize spillage and exposure.

2. Aircraft

   Select the type of aircraft (fixed-wing or rotary wing) with the size and capabilities to "fit the job".

   In forestry, helicopters are preferred over fixed-wing where steep terrain is involved.

...2

3. Spray Equipment
Select a boom design, nozzles (type, size, orientation) and a low pump pressure to minimize the potential of spray drift. These factors will be important for achieving many large uniform droplets with few small drifting droplets. Spray equipment should be calibrated with water (or other appropriate diluent) using the intended spray height, swath width and air speed. The addition of a dye will permit observations of spray droplet size and distribution on white cards (e.g. Krome-cote).

4. Timing
Timing should take into consideration the most vulnerable stages of the pest, the least vulnerable stages of non-target species, weather conditions and the availability of all equipment and personnel.

5. Communication/Guidance System
Select a system which may include both audial and visual means of communication to guide the pilot for each swath, to relate progress, to instruct on "cut-offs" and to instruct on "cease operations".

6. Weather Conditons
Monitor weather conditions immediately before and during operations with adequate equipment and personnel, and select weather conditions to reduce drift. Wind conditions at ground level and aloft can be monitored using smoke bombs. The conditions associated with local inversions are usually the optimum periods for preventing drift.

7. Mapping
Select maps and air photos of a sufficient scale to properly understand the target area.

8. Flight Patterns
The selection of flight patterns should take into account the height, air speed, width of swath, weather conditions and related matters. Ensure that no spraying occurs over populated areas and open potable water sources.

...3

In forestry, spray patterns often involve following contours. Flight paths should run parallel with buffer strips and sensitive areas wherever possible.

9. Snags

Prior to the operation, remove all snags and other obstructions which may affect the projected flight height and safety of the operation after consulting with the Fish & Wildlife Branch.

10. Boundary Marking

There are several methods of marking boundaries and buffer zones which require a variety of equipment and personnel. In the case of forestry uses, it is preferable to drop flagging on tops of trees or to spray the margins with whitewash.

11. Monitoring

Select a system from various methods and equipment which will be adequate for monitoring pesticide spray drift. In forestry, cards coated with Krome-cote are usually used. The addition of a dye is a sound practice for all operations where it is practical and where terrain, nozzle selections or other operation variables are difficult to predict.

12. Briefings

All personnel should be thoroughly briefed during one or more meetings prior to the operation as well as on a daily basis during and after operations.

13. Reconnaissance Flight

The pilot, navigator, and other key personnel should make a reconnaissance flight of the entire area to be treated immediately before the operation while the plane contains no pesticide. This would be used primarily to familiarize the pilot with the boundaries, buffer zones and various markers.

...4

Related Concerns

1. Publicity Plan
Besides notification of the intended operation as a condition of the pesticide permit, consider informing the public by radio or other means such as a townhall meeting.

2. Contingency Plans
Contingency or emergency plans must be formulated in the event of a crash, spill, equipment breakdown or other occurrence.

3. Backup Equipment and Staff
For larger operations, it is imperative that backup planes be included.

4. Security Plan
Plans should include the secure storage of pesticides and other key equipment.

5. Safety
Ensure that personnel, including flagmen, are adequately clothed and equipped with safety gear and adequately briefed on the hazards of the pesticide. In large operations, provide for additional water supplies and first aid treatment in case someone is accidentally exposed to a spill of concentrated material. Also provide for adequate fire equipment.

For additional information, contact the local offices of:

1. the Regional Pesticide Control Program, Ministry of Environment,

2. the Regional Fish & Wildlife Program, Ministry of Environment,

3. the Regional Forest Pest Management Program, Ministry of Forests,

4. the Ministry of Agriculture and Food,

5. Environment Canada,

6. Fisheries & Oceans Canada.

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1. Health and Welfare Canada, 1975 "Aerial Application of Pesticides - Safety Manual", 160 pages.

2. "Forest Pesticide Handbook of British Columbia", Ministry of Forests, 1984.

3. Warren, L.E. 1976 "Controlling Drift of Herbicides, Part I, 1976; Part 2, 1976, and Conclusion, May 1976, The World of Agricultural Aviation".

4. Chevron Chemical Company, "Application of Paraquat and Diquat by Air".

RWK/bef
October 13, 1983

APPENDIX VII: Erosion Control Procedure for forest roads and degraded slopes in B.C.

W.W. Carr

EROSION CONTROL PROCEDURE FOR FOREST ROADS AND DEGRADED SLOPES IN B.C.

William W. Carr[1]

Forest road construction and timber harvesting operations can accelerate surface erosion and mass wasting in watersheds to the extent where there may be negative impacts on other watershed resources, particularly water quality and fishery values. Through proper pre-development planning and the use of high operational standards, some of these problems can be alleviated though not totally controlled. Unforeseen erosion and land stability problems inevitably arise during and, more often, after forest development. The resource manager must take steps not only to minimize off-site impacts but also to control erosion where possible.

1. MINIMIZE OFF-SITE IMPACTS OF EROSION

All erosion from forest roads and harvesting operations cannot be controlled, especially from road surfaces. In such cases, one must rely on downslope sediment storage to reduce movement of eroded material into an active drainage system (Megahan, 1977). Haupt (1959) and Packer (1967) recognized the importance of a buffer/filter strip, and the obstruction within it, in protecting intervening slopes, other downhill roads, and stream channels from road-originated sediment.

1.1 PROCEDURES

1.1.1. The key factors involved in determining buffer strip width are:
- number
- spacing
- type of obstruction

1.1.2. Packer (1967) rated the effectiveness of various obstructions as follows (from most to least effective):
- mounds and depressions
- logs
- rocks
- trees and stumps
- slash or brush
- herbaceous vegetation

1.1.3. The width of a buffer strip can be substantially reduced by installing effective slope obstructions, such as logs, and spacing them closely.

[1]Former contract researcher for B.C. Ministry of Forests, currently Manager - Consulting Services/Research, Terrasol Revegetation Erosion Control Ltd., Vancouver.

2. EROSION CONTROL ON SEVERELY DISTURBED SITES

Next to adequate control of surface and subsurface water, revegation of denuded soil is the most important means of controlling soil erosion. Seeding with grasses and legumes has been proven effective in halting surface erosion from forest road slopes. The planting of shrubs will not only add diversity to the vegetative cover but can enhance slope stability. The deeper, stronger shrub root systems can be effective in improving soil shear strength and thus may alleviate slope stability problems due to soil creep or flow, and shallow shear or rotational failures. Major slope stability problems will require applied engineering technology. Surface erosion and shallow slope failures, if not prevented or controlled, can lead to large-scale mass erosion which cannot be controlled or corrected.

2.1 GRASS-LEGUME ESTABLISHMENT - PROCEDURES

2.1.1. Refer to "A Handbook for Forest Roadside Erosion Control in B.C.", Land Management Report Number 4, available through Information Services Branch, Ministry of Forests.

2.1.2. Seeding should be done as an integral part of every road construction or forestry operation that results in soil denudation.

2.1.3. Before seeding, ensure that slopes are as mechanically stable as possible. Steep slopes can be improved for seeding by:
- reducing slope grades
- benching or terracing slopes
- rounding the top edges of cut slopes
- roughening the soil surface
- deflecting surface runoff
- applying a temporary cover

2.1.4. Seeding methodology: There are two basic methods of grass-legume seeding - dry broadcast application and hydroseeding.

(a) Dry, broadcast application is basically the spreading of seed on the site by hand, by means of a cyclone-type spreader, or by some type of airblast. Both seed and fertilizer can be applied by this method. Once on the slope, the seed and fertilizer are afforded no protection from wind or surface water flow, thus cover establishment can be sporadic. In general, dry seeding for erosion control is limited to slopes 2:1 or less.

(b) Hydroseeding is the application to soil of a seed and water slurry that may contain fertilizer, a chemical soil binder, and/or a mulch. It requires a special application system that must possess a mixing tank with agitation (either mechanical or hydraulic) and volume pumping capability. Although hydroseeding is more expensive than dry seeding, it has been proven very effective in revegetion of slopes up to 1:1 and steeper. On areas inaccessible to conventional truck-mounted hydroseeding equipment, aerial application of the slurry by helicopter is a proven alternative.

2.1.5. General guidelines for selection of method:

(a) Steep slopes, high erosion hazard - hydroseeding, possibly with mulch;
(b) Steep slopes, medium erosion hazard - hydroseeding or dry-seeding plus mulch;
(c) Gentle slopes, medium erosion hazard - hydroseeding or dry-seeding;
(d) Gentle slopes, low erosion hazard - dry seeding.

2.1.6. Problem sites, such as cut and fill slopes in free-flowing sand which do not respond to normal seeding operations, may require the use of erosion control fabrics or netting material. These materials cannot only enhance the structural nature of a site, but also provide immediate slope protection while acting as a mulch for subsequent revegetation.

2.2 SHRUB ESTABLISHMENT - PROCEDURES

2.2.1. Species selection: shrubs selected for use in erosion control programs must meet three main criteria:

(a) Produce the desired effect - i.e., slope stability, short or tall growth form, browse potential, etc.;
(b) Adaptable to site characteristics - particulary soil moisture and fertility;
(c) Ease of propogation - a limited factor in obtaining planting stock.

Whenever possible, shrubs indigenous to the operation area (or surrounding area) should be used.

2.2.2. Information pertaining to the foregoing criteria can be found in "Manual of Plant Species Suitability for Reclamation in Alberta", Volume 11, Report #RRTAC 80-5, Alberta Land Conservation and Reclamation Council, Edmonton.

2.2.3. Propagation method:

(a) Direct planting of unrooted cuttings. This method is primarily suitable for the following species:
- Populus sp.
- Salix sp.

(b) Procedures:
Vegetation requirements - Cuttings should be:
- taken from stock plants native to the areas of operation;
- in the dormant growth phase;
- of previous season's growth;
- straight, healthy and robust.

(c) Cutting procedures - cutting should:
- be taken with a sharp knife or good quality pruning shears;
- have a length of 20 cm or more;
- have a midstem diameter of 10 to 20 mm;
- have at least two healthy buds.

(d) Planting procedures:
- Timing - planting should take place immediately after snow melt or when moisture stress is lowest;
- Planting systems - dependent upon species, selection, planting pattern, and desired species frequency. In general, grid planting is based on a 1-m x 1-m spacing. Linear planting is based on higher plant density within bands spaced 2-10 m apart. Additional information on various planting patterns is available in "Bioengineering for Land Reclamation and Conservation" by Dr. Hugo Schiechtl, the University of Alberta Press, 1980;
- Depth - cuttings should be planted with as little stem exposed as possible and still possess at least two buds;
- Survival rate - in general 30 to 50% mortality can be expected with direct cuttings.

2.2.4. Planting of rooted cuttings - container or bare-root.

(a) This method allows for use of a wider range of shrub species (species listed below have been successfully propagated by Ministry of Forests - Research Branch):

Rubus sectabilis	Salix sp.
Rubus parviflorus	Cornus sericea
Vaccinium parvifolium	Spiraea douglasii
Betula papyrifera	Symphoricarpos albus
Holodiscus discolor	Rosa sp.
Lonicera involvucrata	Alnus sp.
Philadelphus lewisii	Sambucus cerulea
Ceanothus sanguineus	Physocarpus capitatus

(b) Procedure:
- Obtaining stock - rooted planting stock may be obtained through contract/commercial nurseries;
- Container vs bare-root stock - both types of stock have proven very successful in planting operations, bare-roote is cheaper to produce while container stock is easier to handle and offers a longer planting season.

2.2.5. Planting procedures:

(a) Timing - planting is preferred during the dormant season (Nov. - March) but may be extended to June if moisture stress is not a critical factor.

(b) Planting systems - dependant on species selection, planting patterns, and desired species frequency. Both grid and linear planting are possible. In general, few plants are needed with rooted stock due to greater expected survival.

(c) Survival rate - if proper species selection and time of planting are observed, less than 10% mortality may be expected.

(d) Precautions - planting material must not be allowed to dry out during handling prior to planting.

2.2.6. Experience and local expertise are invaluable in the planning of a revegetation program. The B.C. Ministry of Forests, B.C. Ministry of Environment, B.C. Department of Highways and erosion control consultants/contractors are all available to assist the resource manager.

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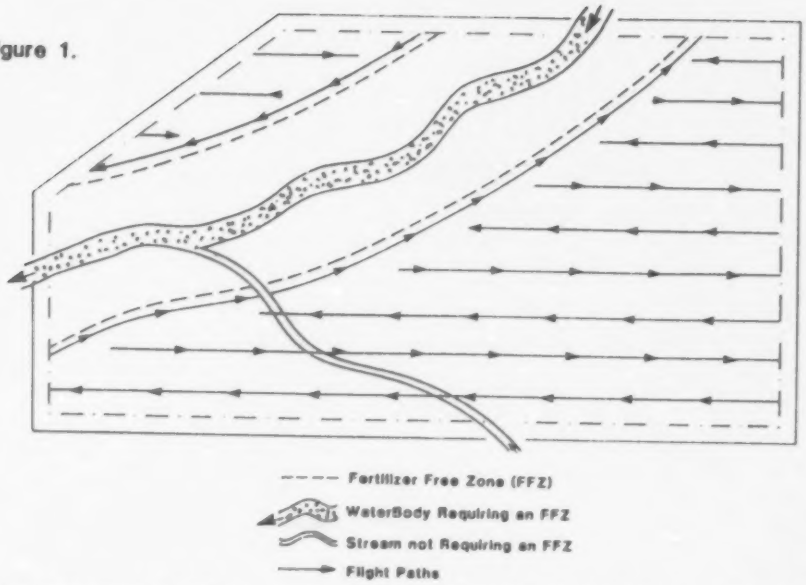
Schiechtl, H. 1980. Bioengineering for land reclamation and conservation. (Translated by N. K. Horstmann) University of Alberta Press, Edmonton. 404 pp.

Watson, L. E., R. W. Parker, and D. F. Polster. 1980. Manual of plant species suitable for reclamation in Alberta. Volume II. Report #RRTAC 80-5, Alberta Land Conservation and Reclamation Council, Edmonton. 541 pp.

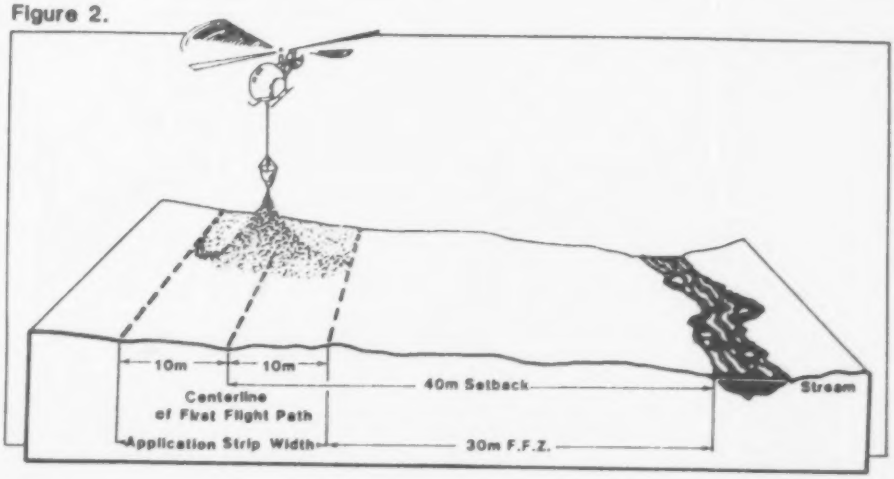
APPENDIX VIII: Protection Methods when using Aerial Application of Fertilizer near Fertilizer Free Zones.

Figure 1.



1. Strategy for laying out a fertilizer free zone on a stream included in an area to be fertilized.

Figure 2.



2. Strategy for laying out a 30 metre fertilizer free zone adjacent to a water body in a nutrient sensitive watershed.(see figure 2)

- Fertilizer application strip width is 20 metres or 10 metres on each side of the flight path.
- Fertilizer free zone width is 30 metres.

First flight path should be set back from the water body by a distance of 40 metres.

APPENDIX IX: Revised Pre-harvest Silviculture Prescription.

Province of British Columbia
Ministry of Forests
Forest Service

PRE-HARVEST SILVICULTURE PRESCRIPTION
FIELD DATA AND INITIAL PRESCRIPTION

Use to record field data and develop initial prescriptions for individual treatment unit or cut block

TENURE

REGION | F D | LOCATION | T S A | TSB | PROPOSED ha

LICENCE NO | LICENSEE | C P | BLOCK | BCGS OPENING NO | SETTING NO | PLOT NO

PHOTO NO | ASSESSED BY (Print) | DATE D M Y

SITE

ELEVATION MIN (m) MAX (m) | ASPECT | PREDOM SLOPE % | SLOPE POSIT | TERRAIN | ROUGHNESS A B C | STOCK RED | OTHER

SOIL DESC

SOIL HORIZONS: Horizon | Depth | Texture | % C F

Rooting Depth ____ (cm) Restrictive Layer Depth ____ (cm)

Humus Form ____ Soil Order ____

Drainage

Landform

Other

VEGETATION DESC

UNDERSTOREY: Species | % Cover | Species | % Cover

SAMPLE TREES: Species | Cm Cl | DBH (cm) | Ht (m) | Age (BH) | 10 yr Gr | % L Cr

ADVANCE REGENERATION: Ht | Species | Density | Age | % Accept

ECOLOGICAL CLASSIFICATION

BGC Zone Subzone Var

Eco Assn Type Phase

Edatopic Grid Moist ____ Nutr

Stand Condition

Stand Composition

PROTECTION

WILDFIRE: LIGHTNING RISK | RECREATION RISK | INDUSTRIAL RISK | OTHER RISKS | ON SITE HAZARDS | ADJACENT HAZARDS | DANGERS

PEST MANAGEMENT: Agent | Incid | Comments

NON TIMBER VALUES

STREAMS AND LAKES: IN OR ADJACENT TO BLOCK | % Grade | HABITAT POTENTIAL | DOWNSTREAM USE | COMMENTS

WILDLIFE HABITAT: SPECIES | CURRENT USE | FUTURE IMPACT | RARE ENDANGERED SPECIES

RECREATION: RECREATIONAL FEATURES | POTENTIAL USE | EXISTING USE | EXISTING FACILITIES

LANDSCAPE: VISIBLE FROM | V SENSITIVITY | COMMENT

RANGE: PRESENT USAGE | RANGE CONDITION | EXISTING IMPROVEMENTS | POTENTIAL USAGE | COMMENT

FS 711A-1 SIL 85/2

INITIAL PRESCRIPTION

☐ NOT HARVEST ▶ REASON

☐ HARVEST

SILVICULTURE PRESCRIPTIONS

SUBJECT	DECISION / REASON	ALTERNATIVE
Species selection Stock type		
Stocking Target Regeneration delay (yrs.) Free growing (yrs.)		
Reforestation method		
System / Season / Method of logging		
Site preparation method		
Brushing & weeding		
Stand tending		

PROTECTION

TREATMENT REQUIRED (Pre-, during, post-harvest) AND / OR LAYOUT CONSTRAINTS

HAZARD REDUCTION REQUIRED ☐ YES ☐ NO

PEST TREATMENT REQUIRED ☐ YES ☐ NO

REC & LSCAPE

MEASURES REQUIRED

RANGE

SEED GRASS | SEED MIX | APPLICATION METHOD | SCARIFICATION REQUIRED

☐ NO ☐ YES ▶

CURRENT GRAZING EFFECTS | PROBABLE PERIOD OF USE

HARVESTING CONSIDERATIONS

ACCESS TO BLOCK

POTENTIAL ROAD CONSTRUCTION AND MAINTENANCE PROBLEMS

EROSION CONTROL

BLOCK LAYOUT

OPENING CONSTRAINTS

ROADS, SKID TRAIL AND LANDINGS

OTHER HARVESTING DETAILS

OTHER RESOURCE CONSTRAINTS

OTHER

COMMENTS OR EXTENSION OF A PREVIOUS SECTION

FS 711A-2 SIL 85 2 Use to develop final prescription for individual cutblock on Form 711B. Store 711A on opening file

Province of British Columbia

Ministry of Forests

Forest Service

PRE-HARVEST SILVICULTURE PRESCRIPTION
FINAL PRESCRIPTION

Use to develop final cutblock prescription from initial treatment unit prescriptions on Form 711A.

TENURE DESC.

REGION | F.D. | LOCATION | T.S.A. | TSB | AREA (ha)

LICENCE NO. | LICENSEE | C.P. | BLOCK | BCGS / OPENING NO. / SETTING NO | PLOT NO.

PHOTO NO. | ASSESSED BY (Print) | DATE D M Y | ECOLOGICAL CLASSIFICATION

MGT. OBJ.

STATEMENT

HARVESTING

CUTTING PRIORITY

CONSTRAINTS | SEASON / YR. TO START

LOGGING METHOD | SEASON / YR. TO FINISH

CONSTRAINTS

RECOMMENDED CUTTING SPECIFICATIONS

OPENING SIZE AND CONFIGURATION RATIONALE

ACCESS ROADS TO BLOCK

ROAD LAYOUT IN BLOCK

SKID TRAILS IN BLOCK

LANDINGS IN BLOCK

CULVERTS AND BRIDGES

RANGE/RECREATION/WATERSHED AND FISHERIES CONSTRAINTS

HAZARD REDUCTION / PEST MANAGEMENT

METHOD/TYPE

SEASON / YEAR

PEST TREATMENT

PROTECTION / SITE PREP CONSTRAINTS

FS 7118-1 SIL 85/2

W-610

REC. & LSCAPE

PROPOSED USE

MEASURES REQUIRED

RANGE

PROPOSED USE

SITE TREATMENTS / TIMING

OTHER IMPROVEMENTS

SILVICULTURE

STOCKING STANDARDS

Treatment Unit Identification		TARGETS Stocking Standard (well spaced / ha)	Stocking Method	Leader Growth (cm)	Species Preferred	Species Acceptable	STANDARDS Minimum Stocking (well spaced / ha)	Regen Delay (yr.)	Free Growing Early Years	Free Growing Late Years

SILVICULTURE PLAN

SITE PREPARATION

Treatment Units	Season/ Year	Method

REFORESTATION

Target Year Sow	Target Year Plant	Selected Species	Selected Stock Type	Selected Stems/ha

GENERAL COMMENTS

METHODS/TIMING

BRUSHING AND WEEDING

CONSTRAINTS

GENERAL COMMENTS

ADMINISTRATION

GENERAL OBSERVATIONS

PROCESSING SUMMARY

Action	Initial	Date Completed D	M	Y
1 Enter History Record				
2				
3				
4				

☐ MAP/PHOTO ATTACHED

MAP SCALE

AFFIX SEAL HERE

Signature of person completing this prescription

Signature of prescription approval (Licensee/Forest Service R.P.F.)

Signature verifying Government Acceptance (Forest Service)

FS 7118-2 SIL 85/2 This form may accompany Cutting Permit Application and should be stored on opening file

Province of British Columbia

Ministry of Forests and Lands
FOREST SERVICE

PRE-HARVEST SILVICULTURE PRESCRIPTION SHORT FORM

(Use this form to provide a description of a specific cut block and plans for future treatments.)

TENURE

REGION	F.D.	LOCATION	T.S.A.	TSB*	PHOTO NO.*

LICENCE NO.	LICENSEE	C.P.	BLOCK*	BCGS / OPENING NO. / SETTING NO.	AREA-(ha)

ECOLOG. CLASS.

BGC ZONE	SUB ZONE	VARIANT*	ECOSYSTEM ASSOCIATION	TYPE/PHASE	GRID LOCATION MOIST.	NUTR.	COMMENTS/SUMMARY

PROTECTION — PEST MGT.

CONCERNS/ACTION:

HARVESTING

SILV. SYSTEM: CLEAR CUT ____ SELECTION ____ SEED TREE ____ OTHER ____ REASON

LOGGING METHOD

LAYOUT CONCERNS

SEASON/YR. TO START	SEASON/YR. TO FINISH

SILVICULTURE PRESCRIPTION

SITE PREP. PRESCRIPTION, TIMING

PROTECTION / SITE PREP CONSTRAINTS

REFORESTATION PRESCRIPTION

STOCKING STANDARDS

Treatment Unit Identification	Area (ha)	TARGETS Stocking Standard (well spaced / ha)	Stocking Method	Leader Growth (cm)	Species Preferred	Species Acceptable	STANDARDS Minimum Stocking (well spaced / ha)	Regen Delay (yr.)	Free Growing Early Years	Free Growing Late Years

SEEDLING REQUIREMENTS

Sp	Age Class	Stock Type	Amount (000 0's)	Sow Year	Plant Year
		Total			

BRUSHING & WEEDING EXPECTED CONSTRAINTS

OTHER SILVICULTURE CONCERNS

ADMINISTRATION

GENERAL OBSERVATIONS

☐ MAP PHOTO ATTACHED

MAP SCALE

AFFIX SEAL HERE

Prescribed by (Print name)

Signature of person completing this prescription Date

Signature of prescription approval - Licensee R.P.F. Date

FS 711C 1 SIL 86 12

* above indicates optional completion

V: 611

NON-TIMBER VALUES - FOR B.C. INTERIOR

IN OR ADJACENT TO BLOCK

STREAMS AND LAKES

% Grade | HABITAT POTENTIAL

DOWNSTREAM USE

COMMENTS

SPECIES

WILDLIFE HABITAT

CURRENT USE

FUTURE IMPACT

RARE / ENDANGERED SPECIES

REC. & LSCAPE

PROPOSED USE

MEASURES REQUIRED

SEED GRASS

SEED MIX

APPLICATION METHOD

SCARIFICATION REQUIRED

☐ NO ☐ YES ▸

RANGE

CURRENT GRAZING EFFECTS

PROBABLE PERIOD OF USE

PROPOSED USE

OTHER IMPROVEMENTS

APPENDIX X: Canada and B.C. Fire Code Regulations for Fuel Storage Tanks.

National Fire Code of Canada
1985
Issued by the Associated Committee on the National Fire Code
National Research Council of Canada
Ottawa

SECTION 4.1 General

Subsection 4.1.6 Drainage and Waste Disposal

4.1.6.1.(1) Except at service stations, appropriate measures to prevent spills of flammable or combustible liquids from entering public sanitary and storm sewer systems and natural waterways shall be provided by grading the site or sloping the floor to divert the spill or by providing noncombustible sills, curbs or dikes of sufficient height to contain it or divert it to a drainage system conforming to Article 4.1.6.2.

(2) When dikes are provided to contain accidental spillage in Sentence (1). they shall conform to Subsection 4.3.7.

4.1.6.2.(1) A drainage system designed to drain spills of flammable or combustible liquids shall terminate at a location which will not create a hazard to public health or safety by contaminating any potable water source, underground stream or waterway, or by entering any sanitary or storm sewer.

(2) Closed drainage systems shall be equipped with a trap.

SECTION 4.3 Tank Storage of Flammable and Combustible Liquids

Subsection 4.3.7. Dikes and Drainage for Aboveground Storage Tanks

4.3.7.1. The area surrounding a storage tank or group of storage tanks shall be designed to accommodate accidental spillage in conformance with Subsection 4.1.6.

4.3.7.2.(1) Except as provided in Sentence (2), the distance between a storage tank shell and the centre line of a dike shall be at least 3 m or 1/2 the tank height, whichever is greater.

(2) For storage tanks having capacities not exceeding 141 000 L, the distance required in Sentence (1) may be reduced to 1.5 m when acceptable. (See Appendix A.).

4.3.7.3.(1) Where a diked area contains only 1 storage tank, the diked area shall be of sufficient size to contain a volume of liquid at least 10 percent greater than the volume of the tank.

(2) Where a diked area contains more than one storage tank, the diked area shall be of sufficient size to contain a volume of liquid at least equal to

the volume of the largest tank plus 10 percent of the aggregate volume of all the other tanks, or 10 percent greater than the volume of the largest tank, whichever is greater.

4.3.7.4.(1) The base and walls of the dike in Article 4.3.7.3. shall be of earth, steel, concrete or solid masonry and shall be designed, constructed and maintained to provide impermeability.

(2) Openings shall not be permitted in dikes in Article 4.3.7.3., and where piping passes through such dikes, such passages shall be designed, constructed and maintained to prevent seepage from the diked area.

4.3.7.5. The walls of every earth dike in Article 4.3.7.3. shall have a flat top at least 600 mm wide, a height of at least 600 mm and slope consistent with the angle of repose of the material.

4.3.7.6.(1) Except as provided in Sentence (3), the walls of a diked area in Article 4.3.7.3. shall not exceed an average height of 1.8 m above the ground level within the enclosing dike.

(2) Dikes in Sentence (1) shall be designed to facilitate access to storage tanks, valves and other equipment, and safe egress from the diked area.

(3) Dikes may exceed 1.8 m above the ground level within the enclosing dike if acceptable provisions are made to facilitate access to the storage tank, valves and other equipment and safe egress from the diked area. (See also Articles 4.3.7.7. and 4.3.7.8.) (See Appendix A.)

4.3.7.7. When either the average height of a dike containing flammable liquids exceeds 3.5 m, measured from the ground level of the interior of the diked area, or when the distance between any tank and the top inside edge of the dike wall is less than the height of the dike wall, and provisions shall be made for the normal operation of valves and for access to storage tank roofs at a level above the top of the dike.

4.3.7.8. When the height or location of dike walls prevents fire fighting access to storage tanks containing flammable liquids or combustible liquids with flash points below 60°C, or when the diameter of a storage tank exceeds 45 m, fire extinguishing measures conforming to good fire protection engineering practice shall be provided. (See Appendix A.)

4.3.7.9.(1) Where provision is made for draining water from diked areas, drainage shall be provided in conformance with Subsection 4.1.6.

(2) Controls for the drainage system shall be accessible under fire exposure conditions and be located outside the diked area.

4.3.7.10. Drums, portable containers and combustible material other than stiles or walkways shall not be permitted in a diked area.

British Columbia Fire Services Act
(R.S.B.C. 1979, Chap. 133)
[Consolidated January 30, 1986]

59. (1) The Lieutenant Governor in Council may make regulations.
(2) Without limiting subsection (1), the regulations may
(b) regulate the manufacture, storage, carriage, sale and disposal of a combustible, explosive or flammable matter,

APPENDIX XI: Glossary

GLOSSARY

Abandoned Roads
Permanently non-active roads, not required for vehicle access.

Active Logging Roads
Those used for the ongoing development and extraction of timber.

Anadromous
Fish which breed in freshwater but live their adult life in the sea. On the Pacific coast, anadromous fish include all the Pacific salmon, steelhead trout, some cutthroat trout and Dolly Varden char, lampreys, and eulachons.

Anadromous or Sportfish Potential
Refers to the productive capability of a stream reach to support anadromous or resident sport fish whether or not fish are or have been present. Physical stream reach characteristics (eg. gradient, water flow, depth and temperature, spawning gravel, etc.) are compatible with those required for fish production. The absence of fish may be attributed to natural or manmade barriers, the absence of a specific feature required for one life history phase (eg. spawning gravel) or an earlier catastrophic event. Agency stock management goals or stock enhancement activities should guide the determination of priority or level of protection afforded these areas.

Alevin
A stage of embryonic development of salmon or related fish referring to fish recently hatched from the egg and before absorption of the yolk sac and emergence from the spawning gravel.

Alluvial (see Fluvial)

Back Channel (see Channel and Side Channel)

Bank
The rising ground bordering a stream channel below the level of rooted terrestrial vegetation and above the normal stream bed. In entrenched channels the stream bank and the valley wall may coincide. The left (L) and right (R) banks are defined looking downstream. In the absence of vegetation, (i.e. incised channels) mean annual high water level defines the top of the bank.

Basin (see Watershed)

Bedload
Particulates which are transported along the channel bottom in the lower layers of streamflow by rolling and bouncing.

Benthos
Organisms, both plant and animal, living in direct association with the substrate of a water body (freshwater, estuarine and marine).

Blowdown (Wind Throw)
Uprooted by the wind. Also refers to a tree or trees so uprooted.

Bole
The stem of a tree, once it has grown to substantial size.

Boulders
Rounded inorganic bed or bank material with its intermediate diameter greater than 256 mm.

Braiding
A pattern of river bars with numerous interconnected small channels at lower flows caused by high volumes of bed material in transport.

Buffer Strip (see Leave Strip)
Vegetation fringe left intact along a stream, river or lake after logging. Can be deciduous or a mix of deciduous and coniferous species, including a complete assemblage of natural forest.

Buffer Zone
A strip of land between a pesticide free zone and the treatment area. The purpose of the bufferzone is to prevent entry of residues of the applied material by drift, runoff, or leachate into the pesticide free zone. Although pesticides are not applied directly to the bufferzone, some pesticides may be deposited in the zone by drift, runoff or leaching. The width of the bufferzone necessary to maintain the pesticide free zone is up to the discretion of the applicator who must take into account the type of application, terrain and weather conditions.

Canyon
A deeply intrenched, steep-walled valley, frequently in bedrock.

Cavity Nesting Birds
Birds that nest in holes in trees.

Channel
A waterway of discernable extent which continuously or periodically contains moving water, and has a defined bed and banks.

Channel Width
The width of the channel from rooted vegetation to rooted vegetation. Mean annual high water level is used in the absence of vegetation.

Channelization
Zones of artificially stabilized or diverted channels, usually resulting in a straighter and deeper channel.

Clearcutting
A silvicultural system in which the crop is cleared from a considerable area (generally more than a few acres) at one time.

Cobble
Bed or bank material between 64 and 256 mm in intermediate diameter.

Compaction
The relative density of bed material, usually caused by sedimentation, mineralization or imbrication.

Coniferous
A cone-bearing tree or shrub, including larch or tamarak.

Coppicing
The tendency of certain tree and brush species (ie: alder, big leaf maple) to produce a large number of shoots when a single or few stems are mechanically removed, but the root system is left intact.

Cover
With reference to aquatic habitat, the plants, rocks and other materials (including organic debris) used by fish for shelter and protection from adverse conditions and predation.

Creeks
Small streams.

Cutblock
Specific area planned for timber harvesting, as described in the Cutting Plan.

Cutting Plan
A plan for harvesting the timber from an area defined within a cutting permit. This plan must be aproved by the Ministry of Forests before operations may begin.

Debris (Organic)
Logs, trees, limbs, branches, bark, and other woody material that accumulates in the floodplain, streams or other water bodies. May be naturally occurring or the result of logging.

Large Debris - Includes tree boles, "chunks" (which are pieces with 6 inches diameter and 12 feet long) or stumps.

Small Debris - Pieces smaller than chunks and down to branches.

Fine Debris - Accumulations of coniferous needles, deciduous leaves, etc., and twigs.

Debris Flow/Torrent
Debris flows and torrent flows are rapid mass movements of inorganic and/or organic material with sufficient water content for fluid behaviour. Debris and torrent flows frequently, leave long linear tracks scoured clean of all vegetation and loose surface material, especially in drainage channels.

Debris Transport Capability
The capability of a stream to transport organic debris or sediment which is deposited in the stream channel at some seasonal flow. Flows sufficient to transport debris may not occur every year.

Deciduous
All non-coniferous riparian vegetation, including evergreen broadleaved trees (e.g. Arbutus menzesii).

Detritus
Disintegrated animal and plant material; before decomposition to basic nutrients.

Discharge
The rate of flow or volume of water flowing in a given stream at a given place and within a given period of time.

Drainage Structures
Includes metal and wooden culverts, open-faced culverts, bridges, and ditches.

Drift
Voluntary of accidential dislodgement of aquatic insects from the stream or river bottom onto the water column where they become more available as food items for fish.

Ecosystem
Any complex of living organisms together with all the other biotic and abiotic (non-living) factors which affect them. For example, a forest ecosystem is that part of a forest area which is uniform in climate, parent materials, physiography, vegetation, soils, animals and micro-organisms.

Environmental Sensitive Area (ESA) Program for Timber Supply Areas
ESA's for forestry include potentially fragile or unstable soils that may deteriorate unacceptably after forest harvesting, and areas of high value to non-timber resources such as fisheries, wildlife, water, and recreation.

Ephemeral Stream

Refers to flows of water which occur only after precipitation or snowmelt.

Estuary

A semi-enclosed body of water which has a free connection with the open ocean and within which sea water is measurably diluted with freshwater derived from land drainage (Cameron and Pritchard, 1963).

Falling

The cutting down of individual trees in a logging operation.

Fertilizer Free Zone (FFZ)

The area surrounding a water body which is intended to be free of fertilizer pellets. Although some fertilizer may enter the zone, it will ensure that there is not direct deposition of fertilizer into the water body and also minimize the leaching of fertilizer into the water body.

Fertilizer Free Zone Widths

Fertilizer Free Zone widths will be 10 metres in non-senitive watersheds and 30 metres in nutrient sensitive watersheds.

Water Bodies Requiring a Nutrient Fertilizer Free Zone

Those which are described as follows:

- a lake
- a Class I or Class II mainstem channel, or
- a channel that can be identified, on a pre-flight inspection, as one which will be observable as open water at the time of application and flows into Class I or Class II water bodies.

A water body which has open water, but may not be observable as such at the time of application, may require flagging to assist in identification for buffering purposes.

50 percent Rule

Established in the Coast Logging Guidelines of 1972, "no more than 50 percent of a stream or lake face will be opened during one phase."

Fines

Bed or bank material less than 2 mm in diameter: includes sand, silt, clay and fine organic material.

Fish Habitat

Spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.

Fisheries Official

An employee of the British Columbia Fisheries Branch or the federal Department of Fisheries and Oceans.

Fisheries Sensitive Zones

Aquatic environments which are important for the life history of fish, including areas which may not be defined as streams. Fisheries sensitive zones may include side and flood channels, valley wall ponds, swamps, seasonally flooded depressions, lake littoral zones or spawning areas, estuaries and recreationally fished areas.

Marine Sensitive Zones include herring spawning areas, shellfish beds, marsh areas, juvenile salmonid rearing areas and adult salmon holding areas.

5-Year Development Plan

A plan prepared by the forest industry which outlines the cutting pattern and road layout for a particular sub-unit (often watersheds) over a 5-year period).

Flood Channels

Channels which contain water at high mainstem flow levels.

Flood Plain

Flat land bordering a stream or river and subject to flooding; underlying materials consist mainly of unconsolidated material derived from sediments transported by the stream.

Fluvial

Refers to materials that are transported and deposited by running water.

Food Chain

Series of organisms inter-related in their feeding habits, the smallest being fed upon by a larger one, and so on. Typically consisting of producers (plants), and consumers (animals) including herbivores (plant-eaters) and carnivores (animal-eaters).

Forest Licence

A licence authorizing harvesting on Crown Lands under the Ministry of Forests Act. The licence has a specific term and specifies an Annual Allowable Cut, requires a Management and Working Plan, and specified management activities.

Freshet

A sudden rise in the level and volume of a stream or river, due to heavy rains or rapid melting of snow and ice.

Fry

The young stage of fishes, particulary after the yolk sac has been absorbed.

Girdling

Removing the bark and some of the cambium around the circumference of a tree in order to kill the tree.

Gradient (stream)
The general slope, or rate of vertical drop per unit of length, of a flowing stream.

Gravel
Inorganic bed and bank material between 2 and 64 mm in diameter measured across the intermediate axis. Small (2-16 mm) and large (16-64 mm) gravel may be distinguished.

Gully
Erosion features in valley walls resulting principally from running water.

Gullying
The formation of gullies.

Habitat
Generally, the place where an organism lives. Pertains to the conditions found at such locations, including the physical, chemical, and biological features such as substrate, cover, water and food.

Hydrology
The science of water, its movement over and under the land surface and its properties.

Hydrologic Cycle
The circulation of water from ocean to atmosphere to earth and back to the ocean.

Inactive Logging Roads
Defined as either Limited Access Roads or Abandoned Roads.

Injection
Application of herbicide to a tree through a cut in the bark. Hack and Squirt is one of these methods.

Integrated Resource Management
The process of setting goals, objectives, strategies and policies in a cooperative framework among all watershed resources and resource uses.

Intermittent Stream
A stream with a defined channel, but which is dry for periods of the year; usually the late summer and fall period of low precipitation and no snow melt.

Invertebrates
Animals without backbones. In aquatic systems, includes insects, crustanceans, shellfish, and worms.

Landform
A landscape unit that denotes origin and shape (for example, flood plain, river terrace, and till plain).

Large Organic Debris (LOD)
Entire trees or large pieces which provide channel stability or which create fish habitat diversity in a stream channel.

Leaners
Those trees along the streamside which lean out over the stream and which cannot be felled safely away from the stream with conventional unassisted falling practices.

Leave Strip
Natural vegetation fringe left along a stream, river or lake margin or between cutblocks after logging.

Limited Access Roads
Designed for access only for forest protection and silviculture. Re-openable as harvest roads for the next crop.

Litter Layer
The layer or organic debris, mainly bark, twigs, and leaves on the forest floor.

Logging
Forest havesting activities including falling, yarding and hauling (as well as road building) associated with these activities.

Low Flow Discharge
The lowest discharge recorded over a specified period of time, usually one year. It often occurs in late summer or early fall.

Low Numbers
A Class II stream reach (which may or may not receive recreational use) in which the inherent capability of the reach controls and limits the number of fish that it can support. Numbers are generally below a level which would provide the currently (1984) acceptable recreational opportunity (1 fish/day).

Major Class II or III
The intent is to apply conservative guidelines for large streams which could impact the land base if channel or bank disturbance occurs.

Major Class III or IV
Streams which, because of their size, capacity to transport material, and erosion potential, would be treated as rivers (e.g. Cameron River, or Kennedy River above the falls).

Management and Working Plan
A plan for managing a forest. A statutary requirement for Tree Farm Licences, Forest Licences and Woodlot Licences; usually for a period of 5 years. In TFL's, they cover operations on all tenures within the licence and include inventory data and allowable cut calculations.

Marine Sensitive Zones
See Fisheries Sensitive Zones.

Mass Wasting (Landslides)
The downslope movement of masses of soil and organic matter under the influence of gravity. Sub categories include debris slides, debris avalanches and rockslides.

Merchantable Trees
Those trees which Crown considers to be marketable.

Migration
Deliberate movement from one habitat to another. Includes the downstream movement of young salmonids from streams to sea and upstream movement of adult spawners to spawning streams.

Monitoring
Part of field surveillance, involving the assessment of environmental protection performance and the measurement of environmental impacts.

Moving Debris
Debris, either natural or logging, which will move downstream during periods of high water. It is not anchored in place and usually not covered with mosses or algae. See also debris.

Natural Vegetation
For the purposes of logging guidelines, it includes immature or non-merchantable conifers, deciduous trees, shrubs and ground cover species.

Non-Merchantable Trees
These trees which the Crown does not consider to be marketable.

Nutrient Sensitive Watersheds
Nutrient sensitive watersheds are those where:
- nitrogen/phosphorus fisheries productivity research is ongoing, or
- effluents containing phosphorus are discharged into the system.

If a municipal, industrial, or hatchery outfall or a nutrient rich agricultural discharge is present on a system with the potential for a negative impact on fish production or a recreational fishery through the addition of fertilizer nitrogen, then the watershed is considered to be sensitive. Nitrogen saturated systems may be considered for urea fertilization.

Obstruction (Blockage)
Any object or formation of debris which impedes or blocks water flow and/or fish migration.

Operation Plan
The final level of planning in the Ministry of Forests hierarchical planning system; a plan detailing the logging

techniques, location of roads and landings, and outlining other matters related to forest harvesting and forest crop renewal.

Patch Cutting
A type of clearcutting used for even-aged management in which the cleared areas may be as small as a few acres in size and separated by uncut timber.

Perennial Stream
A stream which has flowing water all year.

Pesticide
Any substance or mixture of substances, other than a device, intended for killing, controlling or managing insects, rodents, fungi, weeds and other forms of plant or animal life that are considered pests.

Pesticide Free Zone (p.f.z.)
A strip of land, usually 10 meters in width, adjacent to a stream or waterbody and measured from the high watermark. The applicator must prevent, as far as possible and to his utmost ability, the entry of pesticides, by direct application, drift, runoff, or as a leachate, into the pesticide free zone. It is recognized that very low levels (parts per billion or trillion) are commonly found in all areas with new detection technologies. However, the pesticide free zone is to be maintained by the professional capabilities of the applicator who is qualified to make the necessary judgements regarding equipment, terrain, and weather conditions. Specific authorization is needed if the Pesticide free zone is to be less than 10 meters.

Pesticide Use Permit
A Pesticide Use Permit must be obtained from the Pesticide Control Branch to apply a schedule I, II, III, or IV pesticide to a body of water other than one that is man made and self contained; to public land; or to land used for forestry, transportation or public utility purposes.

Pistol Butt Trees
Trees with a sweep or bow in the butt.

Planning
The determining of the goals and objectives of an enterprise, and the selection, through a systematic consideration of alternatives, of the policies, programs and procedures for achieving them. An activity devoted to clearly identifying, defining and determining courses of action necessary to achieve predetermined goals and objectives.

Pool
Section of a stream or river of considerable depth for the size of stream, usually with slowly flowing water and a smooth surface.

Pool-Riffle Ratio
The ratio of the total length of riffle divided into the total length of pool. This ratio is a measurement used to predict the stream's capability of providing resting and feeding pools for fish and riffles to produce food and support spawning. The common interpretation is that a ratio of 1 to 1 is optimum.

Population
A group of individuals of any species in a location or area.

Potential
See Anadromous of Sportfish Potential.

Primary Production
The photosynthetic process by plants whereby nutrients and sunlight are converted to carbohydrate food.

Producer
A plant producing carbohydrate food from carbon dioxide, nutrients and sunlight.

Productive Lake Littoral Zone
The shallow or shoal area around a lake where the penetration of light to the bottom permits plant and associated invertebrate production.

Provincial Forest
A forest land designation whereby areas are set aside for timber production. The uses of Provincial Forests include timber production, forage production, forest recreation, and water, fisheries, and wildlife resource purposes.

Rain-on-snow
A precipitation and runoff event in which rapid snowmelt is augmented by rainfall.

Raptors
Birds of prey, including eagles, vultures, osprey, hawks, owls, and falcons.

Reach
A relatively homogeneous section of a stream having a repetitious sequence of physical processes and habitat types.

Rearing (Fish)
Adj. Growing; usually pertaining to younger stages - fry and juveniles.

Verb. The early life activities of growth and survival, including feeding, territorial defence, and respiration.

Referral
The process whereby applications for permits, licences, leases, etc. which are made to one Government agency by an individual or industry are given to another agency for review and comment. For example, the Fisheries and Oceans review of a Cutting Plan Application is part of the Ministry of Forests/Department of Fisheries and Oceans referral process.

Regional Plan
The intermediate planning level in the Ministry of Forests hierarchical planning system. The Regional Forestry Plan contains forest management alternatives based on a detailed analysis of timber supply within the region. Regional priorities for integrated uses are identified anid taken into account in setting production goals for timber, range and forest recreation.

Resident Fish (see Anadromous Fish, Sport Fish)
Fish that remain in fresh water; non-anadromous.

Resident Sport Fish
A non-anadromous fish which is large enough to be recreationally used pursuant to the British Columbia Sport Fishing Regulations.

Resource Folio
A collection of resource capability and forest inventory maps, other resource data, interpretations, and management objectives for each resource sector. General prescriptions are developed to achieve the stated use objectives. A Resource Folio forms the basis for the timber licensee's development.

Riffle
A section of stream or river of shallow depth and rapid current with surface flow broken by gravel, rubble, or boulders. Usually separated by deeper pools.

Riparian Zone
The stream bank and flood plain adjacent to streams or water bodies, with particular reference to the vegetation.

Rivers
Large streams.

Salmonid
Of the Salmonidae family of fishes; including the Pacific salmon, trout and char.

Sand
Inorganic bed or bank material between 0.062 and 2 mm in diameter.

Sedimentation
The process of subsidence and deposition of suspended matter carried in water by gravity; usually the result of the reduction of water velocity below the point at which it can transport the material in suspended form.

Senescent
The dormancy phase of perennials.

Sidechannels (see Fisheries Sensitive Zone)
Channels within the flood plain connected to the main stream at high flow levels; they may or may not be connected at low flows, and are characterized by much lower current velocities.

Silt
Inorganic bed or bank material between 0.004 and 0.062 mm in diameter.

Silvicultural Practices
Maintenance of the productivity of forest land and sites, restocking of denuded forest lands with commercial species, protection against fire, insects and diseases to predeterminal standards. As used as a section heading in the guidelines, this term is confined to logging, waste disposal, fertilization and biocide application.

Slashing
This method includes brush saw treatment but it generally refers to any cutting of brush lower than approximately 3 meters in height.

Slide
A mass movement process in which slope failure occurs along one or more slip surfaces and in which the unit generally disintegrates into a jumbled mass en route to its depositional site. A debris flow or torrent flow may occur if enough water is present in the mass.

Slope
The angle of the land surface with respect to the horizontal; expressed as percent or degrees.

Slump
A mass movement process in which slope failure occurs on a usually curved slip surface and the unit moves downslope as an intact block, frequently rotating outward. Slumps appear as discrete block movements, often in place, whereas slides usually break up and travel downslope.

Smolt
A one-or-more-year-old juvenile salmonid having undergone physiological changes to cope with a marine environment. Usually refers to the downstream migrants of fish in this conditions, or those salmonids (coho, chinook, and sockeye salmon, and steelhead and cutthroat trout) exhibiting silvery colouration and downstream movement to sea.

Snag
A standing dead tree.

Special Use Permit
A permit from the provincial Ministry of Forests for use of upland areas for special purposes; usually concerning log handling activities.

Sport Fish (See Anadromous Fish, Resident Fish)
Fish which are recreationally pursued. These include anadromous fish and larger resident fish, often found in lakes, and in streams of lower gradient and higher productivity which are often accessible to a larger stream or a lake.

Stable Debris
That portion of debris within or adjacent to the stream channel which is very unlikely to be moved, even at high flows. Stable debris is usually embedded in or attached to the bed or bank and forms a part of the stream's morphologic character.

Stream
The watercourse formed when water flows between continuous definable channel boundaries. Flow in the stream channel may be perennial or intermittent.

Stream Channel
The stream bed and banks formed by fluvial processes, including deposited organic debris.

Stream Order
A system of numbering stream segments as part of a drainage basin network. First-order streams have no tributaries; those that receive only first-order segments are second-order; segments that receive first and second order tributaries are designated third-order, and so on.

Streambank
The rising ground bordering a stream channel.

Streambed
The bottom of the stream below the usual water surface.

Streamside
The land, and the vegetation it supports, immediately in contact with the stream or sufficiently close to it to have a major influence on, or to be influenced by, its ecological character.

Streamside Management Zones
The land, together with the vegetation it supports, immediately in contact with the stream and sufficiently close to have a major influence on the total ecological character and functional processes of the stream. The size and configuration of each streamside management zone can only be determined by site-specific analysis. On Class I and Class II, these would be determined using the same criteria. On Class III and Class IV reaches of

significant width with potential for bank and channel erosion problems, similar criteria and zones would be required.

Stubbling
Mechanically slashing brush and treating the remaining "stubble" with a herbicide.

Substrate
The materials making up the streambed; usually described as bedrock, boulders, cobbles, gravels, sands, and silts. Also includes organic material.

Sub-Unit Plan
An intermediate level of planning in the Ministry of Forests hierarchical planning system. The aggregation of a number of courses of action in map and written form designed to achieve subunit objectives. Normally centred on watersheds.

Surficial Materials
Naturally occurring unconsolidated materials including soil which covers the earth's surface.

Surveillance
The overall observational and measurement program, involving monitoring of environmental policies and impacts, and inspection and enforcement of specific measures and requirements.

Texture
The make-up of surficial materials by particle size and shape.

Timber Operability
The economic suitability of timber for harvesting. Parameters to consider in assessing operability include terrain, timber quality, timber size, operating season, labour costs, development costs, and transporation costs. In the Environmental Protection Area program, operability refers to freedom from harvesting constraints which include access, environmental protection and other forest uses.

Timber Sale Licence (TSL)
A licence authorizing timber harvesting on Crown land under the Ministry of Forests Act for a term not exceeding 10 years.

Timber Supply Area (TSA)
An area defined by a established pattern of wood flow from management units to the primary timber-using industries.

Time Phase Sequence
Scheduling the removal of streamside deciduous tree species over a period of years such that adequate levels of cover and inputs of nutrients, detritus, and terrestrial insects will be maintained. The extent at which vegetation may be treated will depend on the regeneration recovery time of adjacent previously treated areas.

Tree Farm Licence (TFL)
Privately managed forestry units. Designed to enable owners of Crown-granted forest lands and old temporary tenures or the timber licences which replace them, to combine these with enough unencumbered Crown land to form self-contained sustained yield management units. These licences commit the licensee to manage the entire area under the general supervision of the Ministry of Forests. Cutting from all lands requires Ministry approval through the issuence of Cutting Permits. Tree Farm Licences should not be confused with Certified Tree Farms under the Taxation Act. A TFL has a term of 20 years.

Topographic Break
A distinct change in the slope of the land.

Topography
A general term to include characteristics of the ground surface such as plains, hills and mountains, degree of relief, steepness of slopes, and other physiographic features.

Unavoidable
In this proposed stream classification unavoidable adverse effects refer to those ecological changes to the stream ecosystem which even the best possible forest harvesting process may cause (e.g. the replacement of large old growth trees with smaller second growth trees). It specifically does not include effects due to measures or the lack of measures dictated by cost considerations.

Unstable Banks
Stream banks, or valley walls entering the channel, which are actively failing.

Velocity
The rate of water movement in m/s.

Watershed
The entire basin area drained by a stream or lake.

Watershed Management
The managment of the natural resources of a drainage basin for the production and protection of water supplies and water based resources (including fish).

Yarding
In logging, the hauling of felled timber to the landing or temporary storage site from where trucks (usually) transport them to millsite. Yarding methods include cable yarding, ground skidding, and aerial methods such as helicopter and balloon yarding.